SECOND ANNUAL REPORT
OF THE
STATE
OIL AND GAS SUPERVISOR
OF CALIFORNIA

1916-17

BULLETIN No. 38

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BULLETIN No. 82

SECOND ANNUAL REPORT

OF THE

State Oil and Gas Supervisor of California

FOR THE FISCAL YEAR 1916-1917

Covering Operations of the Department of Petroleum and Gas of the State Mining Bureau

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Submitted to

FLETCHER HAMILTON, State Mineralogist

by

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CALIFORNIA STATE PRINTING OFFICE
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LETTERS OF TRANSMITTAL.

February 18, 1918.

To His Excellency, the Honorable William D. Stephens,

Governor of California.

Sir: I have the honor to transmit herewith Bulletin No. 82 of the State Mining Bureau, being the Second Annual Report of the State Oil and Gas Supervisor, relative to the work of protecting the oil fields from damage by infiltrating water.

The work of the Petroleum Department, which met with uniform success from the outset, has continued to expand during the past year and, as the pages of this report show, some notable results have been attained along the lines of practical conservation.

In interpreting the problems which present themselves, it is the practice of the Department to consider them from the viewpoint of the operator as far as possible. This method of procedure has, it is believed, resulted in the fullest cooperation of all concerned, and while there is still room for improvement, it is an undoubted fact that the condition of the petroleum industry in California, taken as a whole, is at the present time highly satisfactory, both from the standpoint of production, and operating methods.

Respectfully submitted.

Fletcher Hamilton,
State Mineralogist.

To Fletcher Hamilton,

State Mineralogist.

Sir: I have the honor to present herewith my Second Annual Report, covering the operations of the Department of Petroleum and Gas of the State Mining Bureau, as required by law.

The harmonious conditions under which this work has been carried on since its inauguration have continued to exist during the past year, and it is with pleasure that I hereby acknowledge the assistance due to your efficient and broadguaged supervision in this matter.

Respectfully submitted.

R. P. McLaughlin,
State Oil and Gas Supervisor.

CHAPTER I.

By R. P. McLAUGHLIN, State Oil and Gas Supervisor.

The work of the Department of Petroleum and Gas of the State Mining Bureau during the second year of its operation shows considerable advance over previous accomplishments.

The legislation authorizing the establishment of the department followed a general demand, caused by oil field operations which were so haphazard and inefficient that they seriously interfered with the profits of persons engaged in the production of oil and also threatened to destroy or waste the oil resources upon which the varied industries of the people of California are dependent. The entrance of the United States into the war makes the saving of oil extremely important at the present time.

The value of an oil property depends almost entirely upon its underground condition. This condition, being invisible, can only be determined by careful scientific study. Surface equipment, while necessary for conducting operations, is of minor importance. Managers of oil properties have, during maintenance or appraisal, frequently devoted great pains to determining details relative to mechanical efficiency and value of operating plants. General efficiency and maximum profits are not obtained by centering attention on such details as relative cost of production with various kinds of pumps or sources of power while investigation of the underground condition of the wells is ignored or incompletely pursued. Properties having excellent and expensive compressor plants for lifting water from wells, or using ingenious and elaborate devices for separating water from oil, are frequently pointed out as models of efficiency. In many such cases it will be found that systematic construction or repair of wells will entirely obviate the necessity of such plants and their attendant cost.

While passing on individual problems, the department has continuously kept in view the main underlying feature of its work, namely, the general elimination of inefficient underground operations. All wells drilled have an intimate relation to all others in the immediate vicinity and no field operations can be properly conducted unless they are in harmony with a general plan based on careful and widespread study. Such studies can only be conducted by some governmental institution authorized to collect the necessary facts from all parties and enforce recommendations.

However, a governmental institution can not be expected to furnish operators with all the details necessary for the proper operation of their properties. Such an assumption could only follow a policy of complete

governmental ownership and operation of all the oil fields. This department has not assumed that such a policy is contemplated, and has therefore called the attention of operators to the necessity of their giving careful study to their own underground conditions and then relying upon the department as an adviser or arbitrator. It has, however, been necessary for us to take up and completely work out some old problems, which could have been solved by technical staffs employed by the operators. Such action on the part of the bureau has usually been taken for the educative purpose of proving that the problems could be solved successfully and profitably by merely applying twentieth century, scientific methods. The department will continue to make as many such studies and demonstrations as possible, but the main portion of its activities must, for a considerable time, be devoted to the issuance of specifications on new work and inspecting all work at the wells. Oil operators must, therefore, take steps to thoroughly inform themselves as to the underground conditions of their own properties, or directly invite governmental ownership. There is every reason to believe that operators will follow the former course when it is thoroughly understood.

The steps necessary for an operator to take, in systematically developing oil land, were outlined in the first annual report, and are reprinted on pages 12 to 47 of this report. After thus setting forth the requirements in general terms, the supervisor proceeded to directly call them to the attention of operators, both by correspondence and interviews. Obviously, the most prompt and widespread results were to be expected by first addressing the largest operators, and it is therefore interesting and encouraging to indicate the steps which have been taken by all operators producing more than a million barrels of oil annually.

Public welfare will be served during the present war-time necessity for the utmost economy of labor and materials, together with the maximum production, by a public statement showing to what extent the large operators are utilizing the latest and most approved methods. The operators producing more than a million barrels of oil per year may be classified into three groups: First, those using thoroughly organized and competent technical departments for the purpose of studying underground conditions and directing development work; second, those using technical assistants to some extent, but in an inadequate and imperfectly co-ordinated manner; third, those having no organized department to take advantage of technical information. Applying this classification, the list of operators is as follows:

Southern Pacific Company (formerly operating in the oil fields as the Kern Trading and Oil Company). This company is the pioneer in systematic or scientific oil field work in California, having used such methods from the time of its first operations nearly ten years ago. The public, and particularly the oil producers, are unquestionably indebted to the company for the introduction and widespread demonstration of scientific methods of oil land development. The consulting geologist of the company, Mr. E. T. Dumble, has kindly furnished the following statement of the work of their geological department:

"The geologists have various duties as scouts, map makers, etc., but their duties which pertain to the development of oil are as follows:

"In general, the Chief Geologist's duty is to oversee and check the work of the field geologists and to advise the Superintendent of Construction, in whose hands lie the ultimate authority and responsibility under the management for drilling oil wells.

"The field geologists collect and maintain records of underground structure as developed by our own wells and those of our neighbors. From these records depths for shutting off water and for finishing wells are figured.

"As the wells are drilled the Field Geologist plots the formation each day after the wells reach critical depths. He is required to know what he is plotting—by personal inspection if necessary. He keeps in close touch with the drilling foreman and together they advise the Local Superintendent, where to land pipe, what sands to test, etc. This data is also wired to the Chief Geologist and the Superintendent of Construction if they are in another field or the head office, for confirmation.

"The Field Geologist collects such samples of drill cuttings as are deemed useful, and samples of water for analysis by the Chemist.

"He is required to be present in the derrick when pipe is cemented in the hole and to check the figures of the drilling foreman for depth, amount of water used, etc. When pipe is perforated in the hole he is also required to check measurements.

"The Field Geologist has no authority over drillers; his position is advisory only, but it is absolutely essential that he work in closest harmony with the field drilling department.

"The same is true of the Chief Geologist and his usefulness to the Superintendent of Construction.

"It is further the duty of the geologists to keep themselves informed on all new developments that have to do with underground conditions throughout the whole field and to advise the Drilling Department thereon. If new developments affect possibilities of improving old wells, these facts must be brought to the Superintendent's attention. In general, the geologists are supposed to act as an intelligence department and to keep the Drilling Department informed as far ahead of the drill as possible, while all the authority and responsibility for actual drilling and handling of wells rests in the Drilling Department.

"The field geologists handle, for the Superintendent and under his direction, the detail of reports, notices, etc., required by the State Oil and Gas Supervisor."

The **Associated** and **Amalgamated** oil companies are controlled by the Southern Pacific Company, and have assented to our suggestion that they henceforth direct their work by the same methods used by the parent company.

The **Shell Company** has been operating in California for some three years, and has from the first utilized scientific methods to good advan-

tage. The geological work of the Shell Company of California is carried on in a most systematic manner and has demonstrated its value to the company. We are indebted to the company for the following brief outline of its department:

"The Geological Department is organized as folows: The Production Manager is ex officio head of the Geological Department.

"The Senior Geologist, who has primarily control of all geological work, devotes his time principally to investigation of new properties and exploration work in general. He also has charge of development work on all new properties, until such time as he considers them past the exploratory period.

"They are then turned over to the Development Geologist, who is directly responsible for all geological problems regarding development or production.

"The resident geologists in the various fields report to the Senior Geologist when exploration work is begun, and when a field is developed they report to the Development Geologist. They are given assistants whenever it seems necessary.

DUTIES OF THE RESIDENT GEOLOGIST.

"His most important duty is close observation of drilling wells, collecting samples and obtaining all possible information from drillers so that logs may be as correct as possible.

"Daily he checks up the production of all wells and particularly those just completed or repaired.

"As soon as data is collected on drilling wells and producing wells under observation, he phones to the city office geologist who handles development. A confirmation of this conversation is sent by private wire during the afternoon for future check.

"He takes formation samples from the drilling wells without specific instructions and oil or water samples after instructions from the city office.

"He is instructed to keep in close touch and co-operation with the Deputy Supervisor.

"Finally, he is to keep in mind that he is the most important adviser of the Field Superintendent and that he is to try to assist as much as possible in repairing wells and maintaining production.

"The daily routine is arranged by the Field Superintendent."

The **Standard Oil Company** readily adopted suggestions made by the bureau, and a technical department has been installed, with every evidence of becoming most effective.

The General Petroleum Corporation has for some three or four years directed its underground work by means of technical aid.

The Honolulu Consolidated Oil Company has been specially zealous in developing and utilizing technical and scientific methods.

Atchison, Topeka and Santa Fe Railway Company (operating in the oil fields as the Petroleum Development Company and the Chanslor Canfield Midway Oil Company). This company produces oil in three California fields. Engineering investigations have to some extent governed development work in one of the fields, and recently arrangements have been made to so conduct all work.

Union Oil Company. This company operates in all fields of the state and has recently informed this department that technical methods are to be adopted throughout the territory.

E. L. Doheny interests (American Petroleum Company, American Oilfields Co., Ltd., Pan American Petroleum Investment Company and Doheny-Pacific Petroleum Company) operate in nearly all fields of the state. So far as we are informed, after diligent inquiry, technical methods have not been systematically utilized.

Most operators annually producing less than a million barrels of oil have not applied modern methods. However, a general statement that small operators have been less progressive and efficient than their larger neighbors is certainly incorrect. There have been some notable efforts made by small concerns to scientifically direct their development work during some phase of its progress. A list of such concerns would include the

Alaska Pioneer Oil Company.
Interstate Oil Company.
Lakeview No. 2 Oil Company.
Miocene Oil Company.
Montebello Oil Company.
Nevada Petroleum Company.
Pacific States Petroleum Company.
Recovery Oil Company.
Riverside Portland Cement Company.
Santa Maria Oil Fields, Ltd.
Universal Oil Company.

GENERAL PRINCIPLES GOVERNING DAMAGE BY INFILTRATING WATER.

The desire of the bureau to stimulate interest in the methods of determining the cause of water troubles in oil fields was met by the publication of the first annual report of the State Oil and Gas Supervisor. There has been such a wide demand for the publication that the supply has been exhausted and it has therefore been deemed advisable to here reprint much information of a general nature. The opportunity to revise and amplify has been taken advantage of.

The damage done to oil fields by water arises from the fact that when water is admitted to a sand stratum, saturated with oil, it tends to displace the oil. If the entrance of water is at or near an oil well, it frequently drives the oil away from the well, which then produces only water. This process also continues along the strata and affects neighboring wells in a like manner. The entrance of the water into an oil-bearing sand is due to two primary causes: First, incomplete knowledge of geological conditions surrounding a well; and, second, faulty mechanical conditions in drilling or maintaining the well. There are a great many combinations of these two causes and a general idea of them can most easily be gained by consideration of the following sketches, which are merely a few typical cases and scarcely touch upon the various complications due to geological and mechanical conditions.

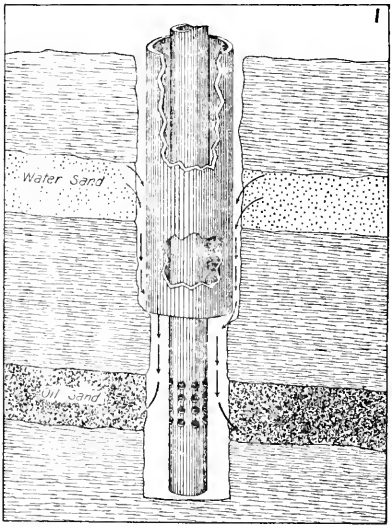


Fig. 1. Sketch showing entrance of water into oil sand due to imperfect seating of casing and to lack of cement around bottom of outer casing.

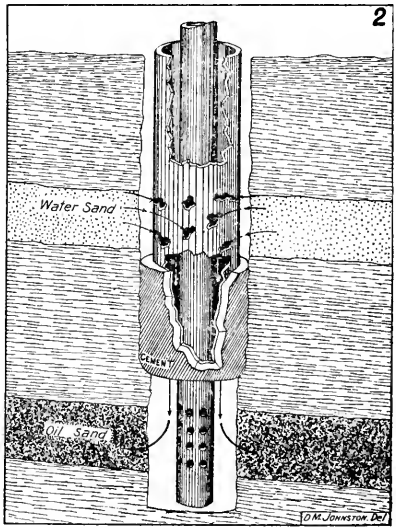


Fig. 2. Sketch showing entrance of water due to holes eaten in casing by chemical action.

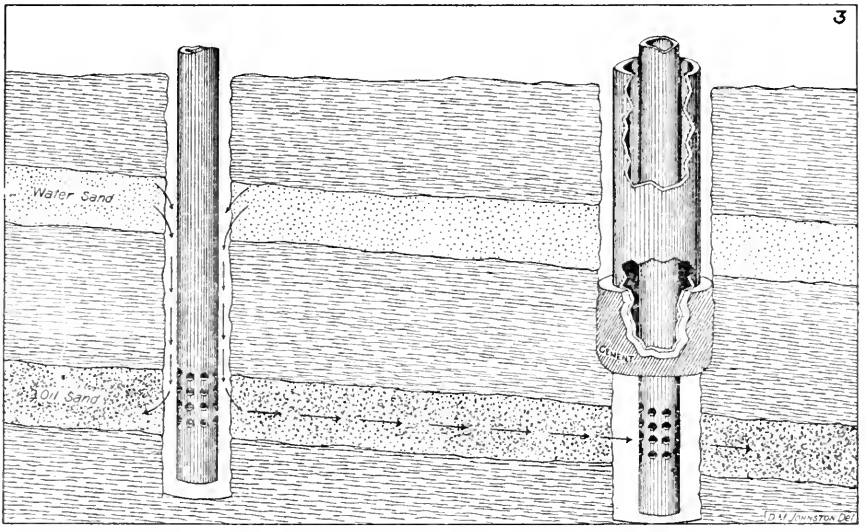


Fig. 3. Sketch showing entrance of water into oil sand and its migration to a properly drilled well. Due to use of only one string of casing in first well.

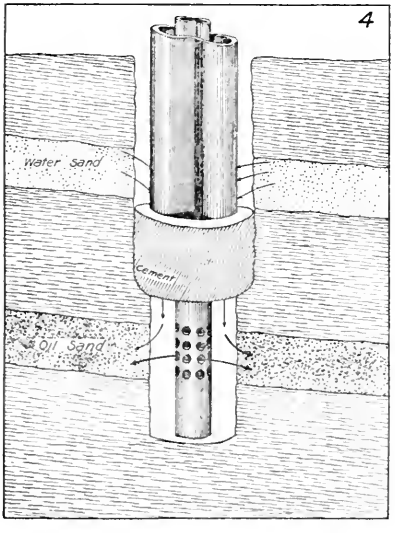


Fig. 4. Sketch showing entrance of water into oil sand due to collapse of casing.

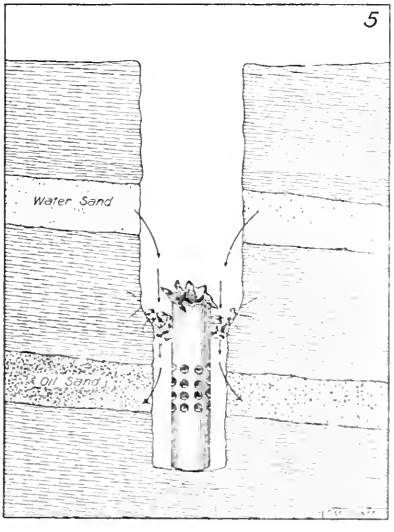


Fig. 5. Sketch showing entrance of water into oil sand due to withdrawal of casing from an abandoned well without placing a plug between oil and water sands.

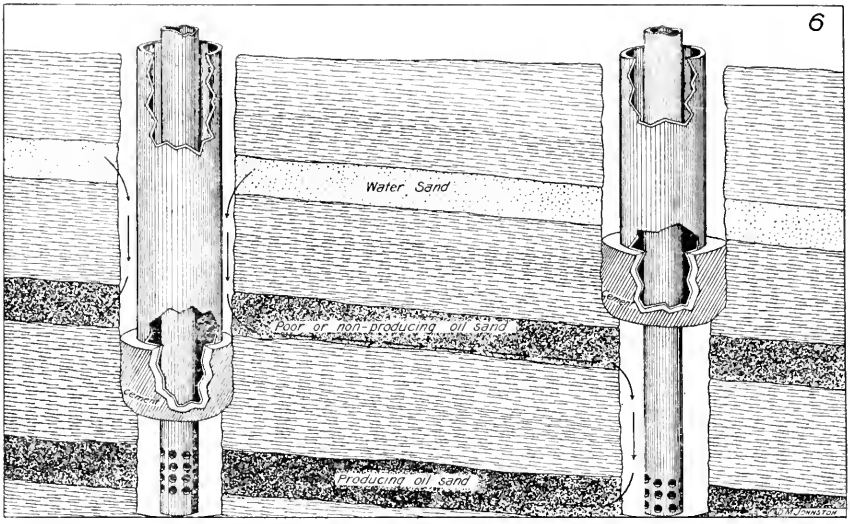


Fig. 6. Sketch showing entrance of water due to lack of uniformity of distance of shut-off below water sands when two wells penetrate the same strata. If there were only one well, either one would probably be in good condition.

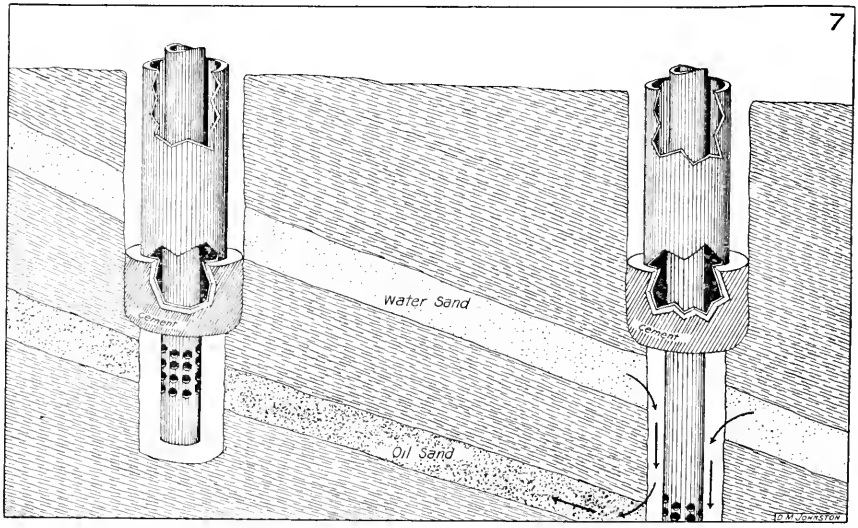


Fig. 7. Sketch showing entrance of water due to fact that shut-off was made at the same depth in two wells without considering the geological fact that strata most frequently do not lie parallel to the ground surface.

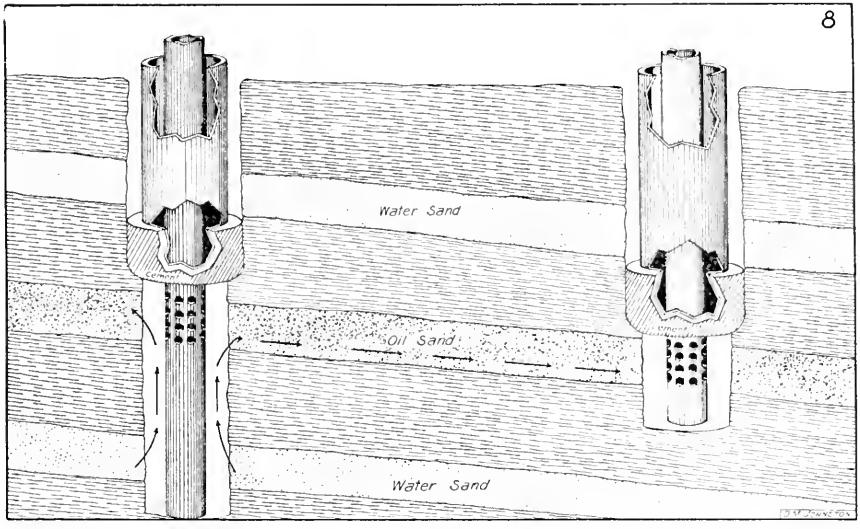


Fig. 8. Sketch showing entrance of water into a properly drilled well due to the fact that another well drilled into a water-bearing sand below the oil sand but did not plug the lower portion of the well.

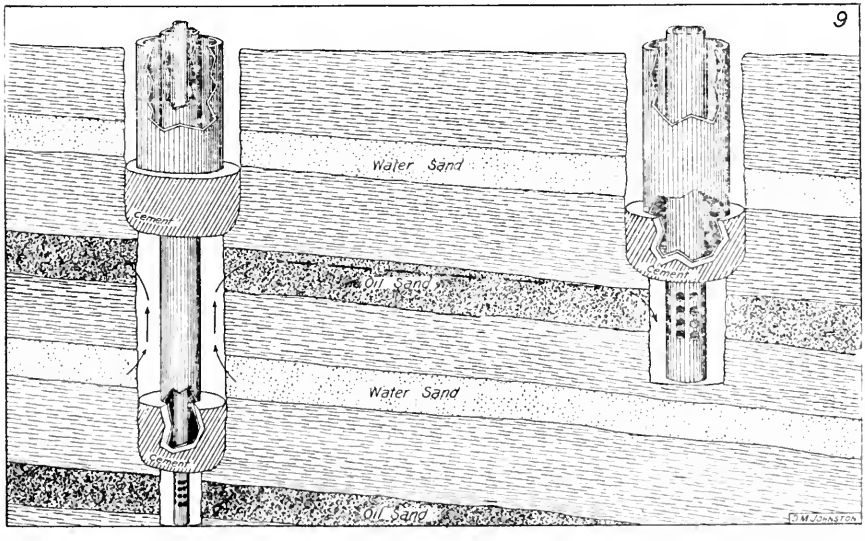


Fig. 9. Sketch showing entrance of water into a properly drilled well because a neighboring well entered a deeper oil sand without inserting an extra string of casing to protect the first sand.

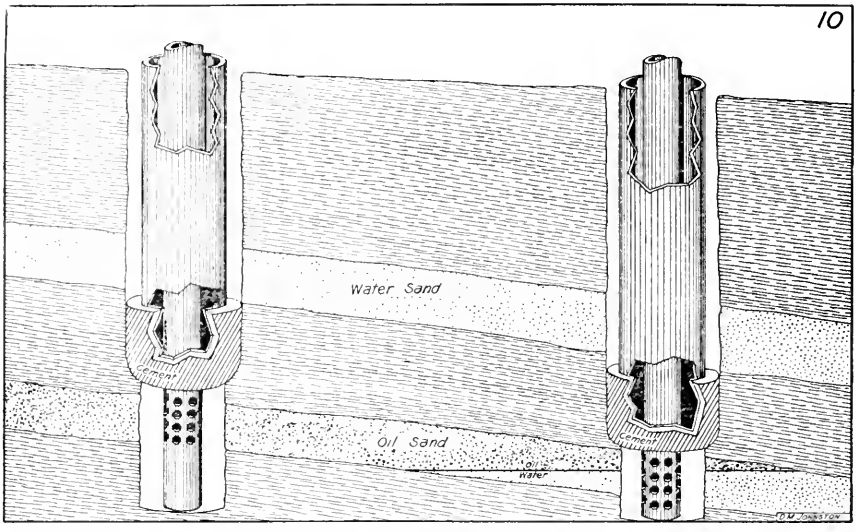


Fig. 10. Sketch showing presence of edge water due to a natural condition. Most oil sands when followed far enough down the dip are found to contain only water. As oil is removed from above, water follows it up along the stratum.

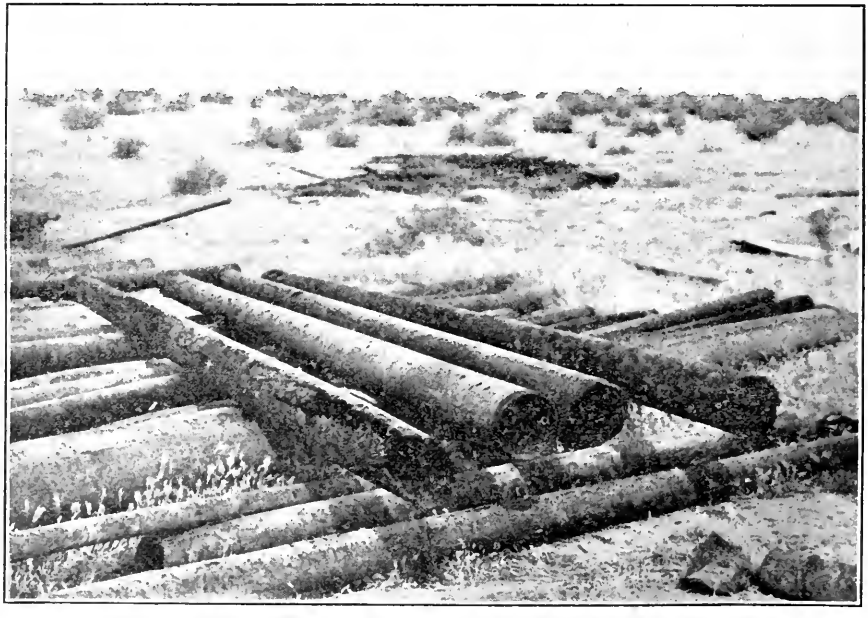


Fig. 11. View of six-inch casing, corroded between depths of 1700 ft. and 1900 ft. after about four years' use. (Photo by Paul M. Paine.)

There are various terms used in dealing with the handling of water in oil wells, and for convenience they can be best defined here in conjunction with the foregoing sketches.

Formation shut-off. The landing of casing in the walls of the well in such a manner as to prevent the passage of water without use of cement, as illustrated in Fig. 1.

Water string. The casing placed in the well primarily for the purpose of preventing water from migrating from its original position to other strata, as illustrated by the casing of larger diameter in Fig. 2.

"Top water." The water found in strata lying above the productive oil formation penetrated by a certain well, as illustrated in Figs. 1 to 7, inclusive. The term is indefinite and should be avoided by using a statement specifically mentioning depth at which the water occurs.

"Bottom water." The water found in strata lying below the productive oil formation penetrated by a certain well, as illustrated in Fig. 8. The term is indefinite and should be avoided as mentioned in the foregoing paragraph.

Intermediate water. The water found in strata between productive oil formations penetrated by a certain well, as illustrated in Fig. 9.

Edge water. The water found in a sand which also contains oil at a higher elevation or, in other words, farther up the dip. Illustrated in Fig. 10.

The administration of the law is based upon the underlying fact that damage from water, as shown in the preceding sketches, is caused by many complications and combinations of physical conditions, and therefore only can be prevented or remedied by first determining, as far as possible, what those conditions are at any particular locality. No definite rule or set of rules could be framed to cover all cases. Like all other engineering problems, this is a subject demanding a tedious collection and comparison of all pertinent facts, and therefore the deputies appointed by the supervisor are, as is required by law, engineers experienced in the drilling and operating of oil wells.

The law provides various means for compelling observance of rulings made by the supervisor, but the co-operation of oil operators has made recourse to these practically unnecessary and they therefore require but little mention here, and it is my assumption that such a condition will prevail in the future. The department aims to serve the property owners and the public as an advisor, rather than a prosecutor.

The information required to be furnished by operators, and necessary to solve existing problems, is of two classes. The first is a complete record or log of each well, giving in detail each and every step taken in its construction and repair, as well as the location and thickness of all strata penetrated so far as can be determined. The second class of information consists of a record continually brought down to date and showing the amounts of oil and of water produced by each well.

PROPER METHOD OF KEEPING OIL WELL LOGS.

Several millions of dollars are spent each year in drilling oil wells in California. In most lines of business an accurate inventory would show exactly what had been obtained in return for the outlay. Many oil operators, however, spend their development funds and have little or nothing in the way of records to show them whether or not the work has been done properly or economically. To remedy such a condition the State Mining Bureau calls attention to proper methods of recording drilling operations, and furnishes complete printed forms for the final summarizing of the logs. It is to the interest of all operators to see that their records are so kept that all the information called for on the bureau's blanks can be supplied.

The first step in keeping proper logs is to see that the operations of the drilling crew are completely written down each and every tour or shift. There are several blank forms in common use which provide a convenient means of making these daily records. The State Mining Bureau does not furnish these forms, but many printers are able to promptly supply the want. One of the handiest methods of keeping these daily drilling reports is to have them bound in book form, one page for each drilling tour. A carbon copy of each page should be made, promptly removed from the book and filed in a safe place, because the original book is subject to loss or easily becomes soiled and illegible. The daily drilling reports show the depth of the well at the beginning and also at the end of the tour, what sort of work the crew was engaged in, the size, weight and amount of casing put in or taken out. It also records the depths at which there were changes in formation, describes or names the formations, and states what evidence there was to indicate the presence of oil, gas or water in the well. Some operators make the carbon copy of the daily report serve as a time card in computing the pay of the crew.

The work of the State Mining Bureau in protecting the oil fields against infiltrating water depends upon full and complete logs of wells, and the law requires that they be furnished to the bureau. Where poor records have been encountered it is usually found that the operator had not kept daily reports.

The blank forms used in recording well logs are as follows:

Form 108.

Fill this blank in with typewriter. Write on one side of paper only

CALIFORNIA STATE MINING BUREAU

FERRY BUILDING, SAN FRANCISCO

LOG OF OIL OR GAS WELL

FIELD _____ COMPANY _____

Township_____ Range_____ Section_____ Elevation_____ Number of Well_____

In compliance with the provisions of Chapter 718, Statutes 1915, the information given herewith is a complete and correct record of the present condition of the well and all work done thereon, so far as can be determined from all available records.

Signed_____

Date_____ Title_____
(President, Secretary or Agent)

The summary on this page is for the ORIGINAL condition of the well

OIL SANDS

1st sand from_____to_____ 4th sand from_____to_____
2d sand from_____to_____ 5th sand from_____to_____
3d sand from_____to_____ 6th sand from_____to_____

IMPORTANT WATER SANDS

1st sand from_____to_____ 3d sand from_____to_____
2d sand from_____to_____ 4th sand from_____to_____

CASING RECORD

Size of Casing	Where Landed	Where Cut	Weight Per Foot	Threads Per Inch	Kind of Shoe	Make of Casing	Cemented: Yes	Cemented: No	Number Sacks

CEMENTING OR OTHER SHUT-OFF RECORD

Casing, Size	Sacks	Time Set	Method	Test and Result (Give water level and hailing results)

PLUGS AND ADAPTERS

Heaving Plug—Material_____Length_____ Where set _____

Adapters —Material_____Size_____

TOOLS

Rotary Tools were used from_____ft. to_____ft.

Cable Tools were used from_____ft. to_____ft.

PERFORATIONS

State clearly whether a machine was used or casing was drilled in shop

From	To	Size of Holes	Number of Rows	Holes Per Foot	Machine—Shop
ft.	ft.				
ft.	ft.				
ft.	ft.				
ft.	ft.				
ft.	ft.				

Thirty days after completion well produced_____barrels of oil per day.

The gravity of oil was_____degrees Baumé. Water in oil amounted to_____per cent.

NAMES OF DRILLERS NAMES OF TOOL DRESSERS

_____ _____

_____ _____

_____ _____

Date drilling started_____ Date well was completed_____

FORMATIONS PENETRATED BY WELL

DEPTH TO: Top of Formation	DEPTH TO: Bottom of Formation	Thickness	Name of Formation

Form 101 30621—12-31-15—10M

CALIFORNIA STATE MINING BUREAU

LOG OF OIL OR GAS WELL—Continued

FIELD_____ COMPANY_____

*Township*_____*Range*_____*Section*_____ *Number of well*_____

FORMATIONS PENETRATED BY WELL

DEPTH TO		Thickness	Name of Formation
Top of Formation	Bottom of Formation		

Form 102 8-10-15 10,000 18678

CALIFORNIA STATE MINING BUREAU

LOG OF OIL OR GAS WELL

FIELD_____ COMPANY_____

*Township*_____*Range*_____*Section*_____*Number of well*_____

In compliance with the provisions of Chapter 718, Statutes 1915, the information given herewith is a complete and correct record of all work done on the well since the previous record, dated_____, was filed.

Signed_____
(President, Secretary or Agent)

Date_____ Title_____

Form 103 20822—12-31-15—10M

CALIFORNIA STATE MINING BUREAU

HISTORY OF OIL OR GAS WELL

FIELD_____ COMPANY_____

*Township*_____*Range*_____*Section*_____ *Number of well*_____

Signed_____
(President, Secretary or Agent)

Date_____ Title_____

It is of the greatest importance to have a complete history of the well. Please state in detail the dates of redrilling, together with the reasons for the work and its results. If there were any changes made in the casing, state fully, and if any casing was "side tracked" or left in the well give its size and location. If the well has been dynamited give date, size, position, and number of shots. If plugs or bridges were put in to test for water state kind of material used, position, and results of pumping or bailing.

The best method of using the written logs of wells is by making from them a drawing showing all the information. Fig. 12 shows the conventional symbols and details adopted by this bureau.

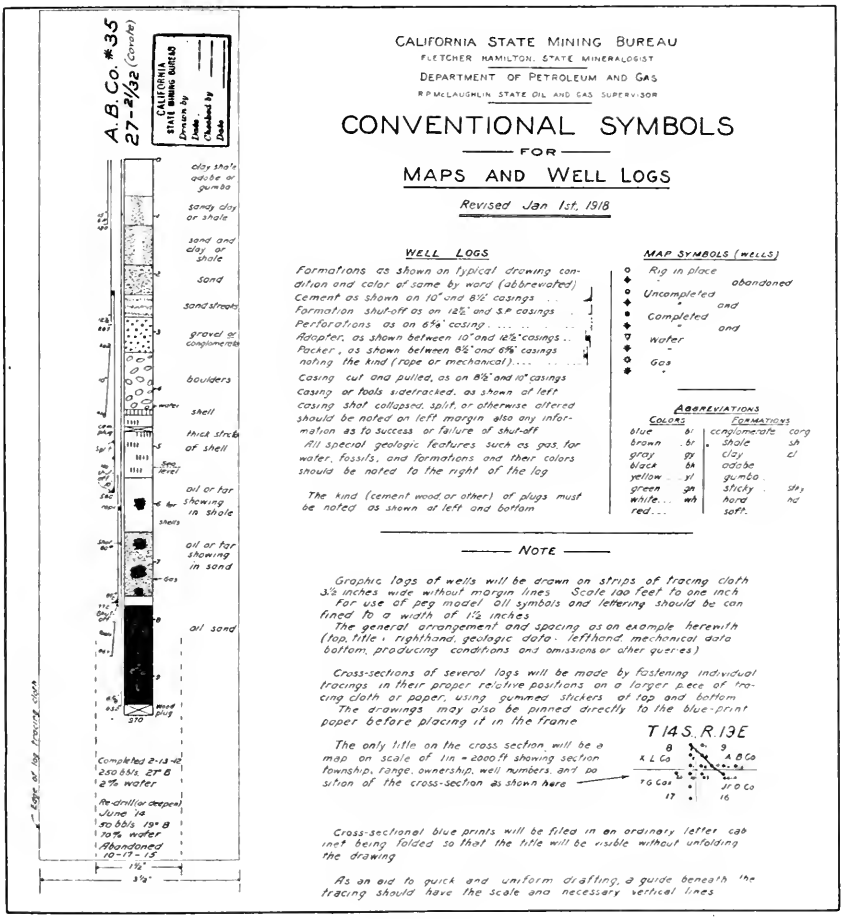


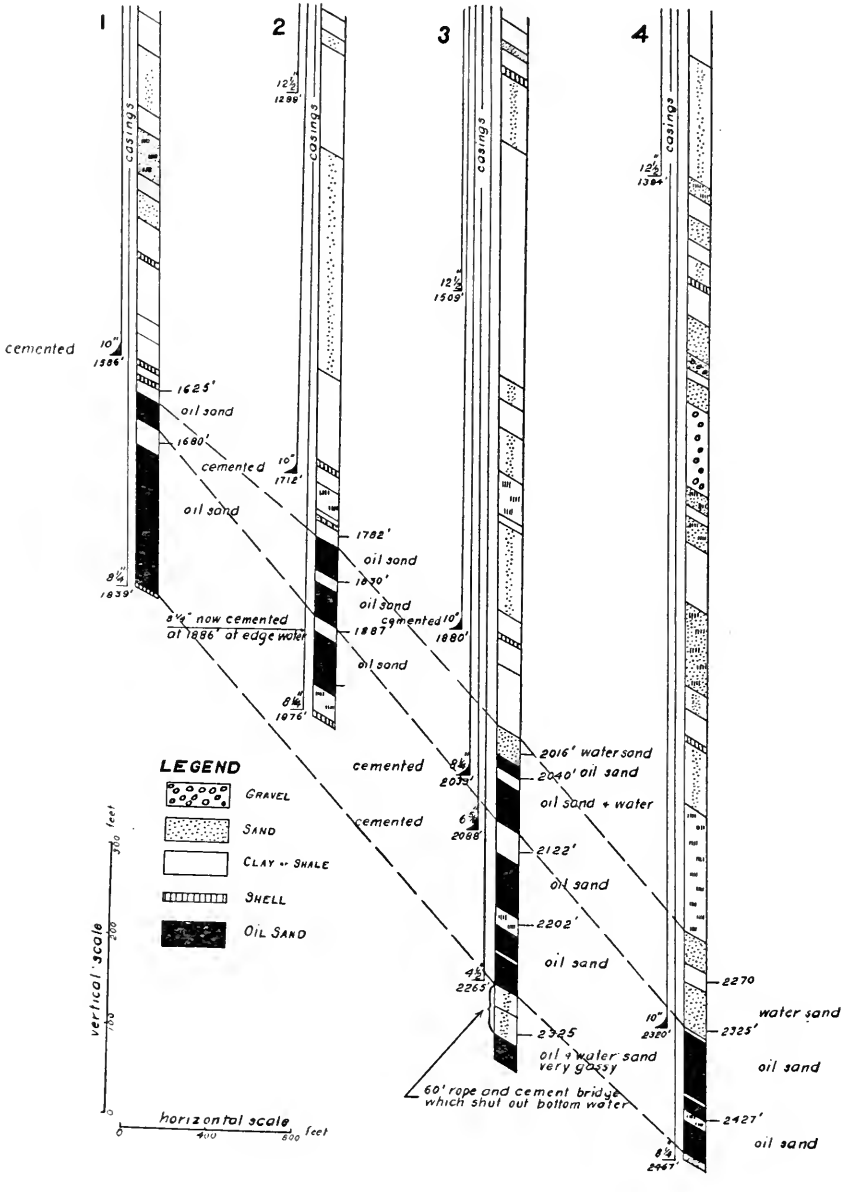
FIG. 12.

CROSS SECTIONS AND THEIR USE.

The various drawings of individual wells, along some approximately straight line on the ground, are grouped on a single drawing called a cross section. They must be properly located on the drawing, relative to distances apart and elevations above sea level.

The appearance of such a cross section and its value are illustrated by the following sketch (Fig. 13) of the bottom of four wells in the Coalinga field:

Figure 13 – CROSS-SECTION *showing underground relation of four oil wells in the* COALINGA FIELD.



The wells were drilled in order as numbered. The strata are not bent or deformed in this particular locality. In each well the 10-in. casing was intended to shut off the water occurring above the oil sands, and in well No. 3 it was landed at a depth of 1880 ft., in conformity with successful results at No. 1 and No. 2. However, the sand between 1980 and 2016 ft. was found to contain some oil and considerable water, hence it was necessary to use more casing to shut off this water. Since some experimenting was necessary, two strings, the 8¼-in. at 2033 ft. and the 6⅝-in. at 2098 ft., were used. Had all conditions been known beforehand, only one string would have been necessary, but when the 8¼-in. casing was landed and the well drilled deeper, more water was encountered and the 6⅝-in. casing had to be used. The final oil string of casing, 4½-in. in diameter, was carried to 2351 ft. and upon testing the well was found to produce mostly water, so the bottom was plugged (using waste, rope, iron lathe-cuttings and cement) up to 2265 ft. and the well again tested, when it was found to be free from water.

Since well No. 3 was one of the first wells in this locality to encounter water in the oil sands, where oil was expected, careful work was necessary on the next well drilled, to check the operations. This was done on the neighboring wells, not shown on the drawing, and, since similar results were found when well No. 4 was drilled, the top sands were shut off with the 10-in. casing at 2320 ft. The well was drilled to 2467 ft. only, so as not to encounter the sand which contained water in well No. 3 between the 2325- and 2351-ft. levels.

After completion, all these wells produced clean oil for about a year and then No. 2 began to show a little water, and about three months later showed about 80 per cent. There were three possible sources of the water: From other wells through the oil sand, or from above the oil sand, or from the bottom sands penetrated. The drawing shows that the possibility of bottom water was slight. The possibility of water from above was tested by removing the 8½-in. "oil string," putting a "bridge" or plug in the open hole between the bottom of the 10-in. "water string" and the top of the oil sand. After bailing the well dry above the plug no water came in, proving that the "water string" was not leaking at any point and was effectively excluding upper water. Therefore, the water in No. 2 was probably coming through the oil sand itself, and as the same sand showed both oil and water between 1980 ft. and 2095 ft. in No. 3, it was concluded that the water was rising along the dip of that sand as the oil was removed. Such a movement is called the encroachment of "edge water." The 8¼-in. casing was again put in and cemented at 1886 ft. in the shale presumed to correspond to that found at 2091 to 2122 ft. in well No. 3, and 2318 to 2325 ft. in well No. 4. After pumping the well for about ten days, the oil was

found to contain less than 1 per cent water, proving that water had been coming through the upper sands between 1782 and 1870 ft. After about four years the water has commenced to show in well No. 1. This movement naturally follows the removal of oil and can not be stopped, but the particular sand affected can be kept separated from other productive sands.

MONTHLY PRODUCTION REPORTS.

Any person giving the slightest consideration to the matter will readily see that it is necessary to keep continuous records of the production of oil wells, showing the amounts of both oil and water coming from them. Aside from the necessity of such records in tracing the origin and course of water troubles in a group of wells, such records are of the utmost value to the owner of the wells, as otherwise he has no means of determining whether or not various wells are paying for their upkeep and operation.

A statement that many oil companies do not really know the actual financial results of their field operations might seem to be an exaggeration, but such is actually the case, and the first step necessary in a proper accounting system would be some form of production report, similar to that used by the bureau. The report blank used by the bureau is shown on the following page.

The monthly production report provides only for collecting the elementary information needed by any operator managing a property. It is believed that very little effort will be required to fill the blank at a properly operated property. The various terms used on the blank form are here more fully explained.

Barrels of clean oil. This figure should be as accurate as possible, but an actual measurement at each well need not be insisted upon, as the superintendent can ordinarily make a fairly close estimate.

Barrels of water. This figure should, if possible, be obtained by some sort of measuring or gauging system, but if that is impossible it may be computed from the results of a centrifuge test made on oil from the lead line. The centrifuge test is frequently quite inaccurate, owing to the small volume of the sample tested and the great variation, from time to time, in the behavior of a well.

Method of determining amount of water. When some actual measuring or gauging system is used, the letter M should be marked in the space. If a computation is made from a centrifuge test the letter C should be inserted.

Percentage of water. This figure is best determined directly from the amounts of oil and water produced (divide the number of barrels of water by the total number of barrels of fluid), but when either

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EMARKS

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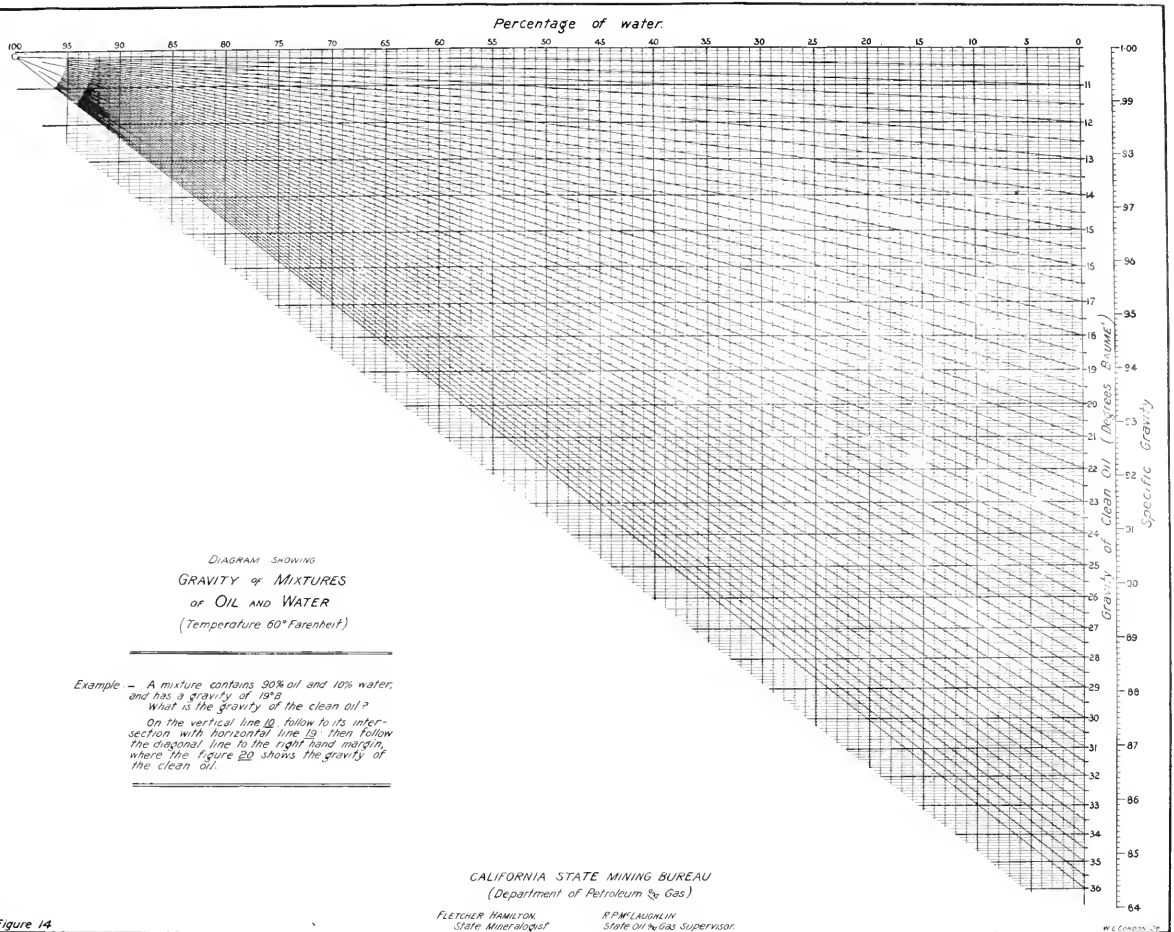
Percentage of water.
100 95 90 85 80 75 70 65 60 55 50 45 40 35 30 25 20 15 10 5 0
11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36
1·00 99 98 97 96 95 94 93 92 91 90 89 88 87 86 85 64
Gravity of Clean Oil (Degrees Baumé)
Specific Gravity
DIAGRAM SHOWING
GRAVITY OF MIXTURES
OF OIL AND WATER
(Temperature 60° Farenheit)
Example – A mixture contains 90% oil and 10% water, and has a gravity of 19°B
What is the gravity of the clean oil?
On the vertical line 10, follow to its intersection with horizontal line 19; then follow the diagonal line to the right hand margin, where the figure 20 shows the gravity of the clean oil.
CALIFORNIA STATE MINING BUREAU
(Department of Petroleum & Gas)
FLETCHER HAMILTON, State Mineralogist
R.P.McLAUGHLIN, State Oil & Gas Supervisor
W.E.CONDON, Jr.

Figure 14

Form 118. 23656—9-11-16—10M

CALIFORNIA STATE MINING BUREAU
Department of Petroleum and Gas
MONTHLY PRODUCTION REPORT

_____Cal._____191__

Mr._____
Deputy State Oil and Gas Supervisor

_____Cal.

Dear Sir:

In compliance with Section 20, Chapter 718, Statutes of 1915, we herewith submit our report of the amount of oil produced by each of our wells in the_____Field _____County, California, for the month of_____191__

Section	Township	Range	Well No.	Barrels of Clean Oil	Barrels of Water	Method of Determining Amount Water	Percentage of Water	Gravity of Oil	Number of Days Well Produced	Remarks

Total barrels clean oil_____ Average gravity_____

_____
(Name of Company or Operator)

By_____

(This report must be made in duplicate, not later than the 10th of the following month, and delivered to the Deputy Supervisor in charge of the district where the property is located)

amount is not measured, give the result of one or the average of several centrifuge tests of oil from the lead line.

Gravity of oil. This figure is in degrees Baumé as determined with a hydrometer; it varies but little and two or three tests per year should suffice. The true gravity of oil which is mixed with water can be determined by means of a test of the mixture and a study of the following diagram (Fig. 14).

Number of days well produced. This figure should as nearly as possible eliminate all the idle time. Some operators keep record of the number of hours each well pumps, which would, of course, furnish the best figure for this report.

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Form 110 25036—8-11-16—10M

CALIFORNIA STATE MINING BUREAU
Department of Petroleum and Gas
MONTHLY PRODUCTION REPORT

.....Cal.....191..

Mr.....
Deputy State Oil and Gas Supervisor
.....Cal.

Dear Sir:

In compliance with Section 20, Chapter 718, Statutes of 1915, we herewith submit our report of the amount of oil produced by each of our wells in the.....Field .....County, California, for the month of.....191..

Section	Township	Range	Well No.	Barrels of Clean Oil	Barrels of Water	Method of Determining Amount Water	Percentage of Water	Gravity of Oil	Number of Days Well Produced	Remarks

Total barrels clean oil..... Average gravity.....

.....
(Name of Company or Operator)

By.....

(This report must be made in duplicate, not later than the 10th of the following month, and delivered to the Deputy Supervisor in charge of the district where the property is located)

amount is not measured, give the result of one or the average of several centrifuge tests of oil from the lead line.

Gravity of oil. This figure is in degrees Baumé as determined with a hydrometer; it varies but little and two or three tests per year should suffice. The true gravity of oil which is mixed with water can be determined by means of a test of the mixture and a study of the following diagram (Fig. 14).

Number of days well produced. This figure should as nearly as possible eliminate all the idle time. Some operators keep record of the number of hours each well pumps, which would, of course, furnish the best figure for this report.

Remarks. The report should account for every well on the property and this column can be used to state the reason for idleness of any well.

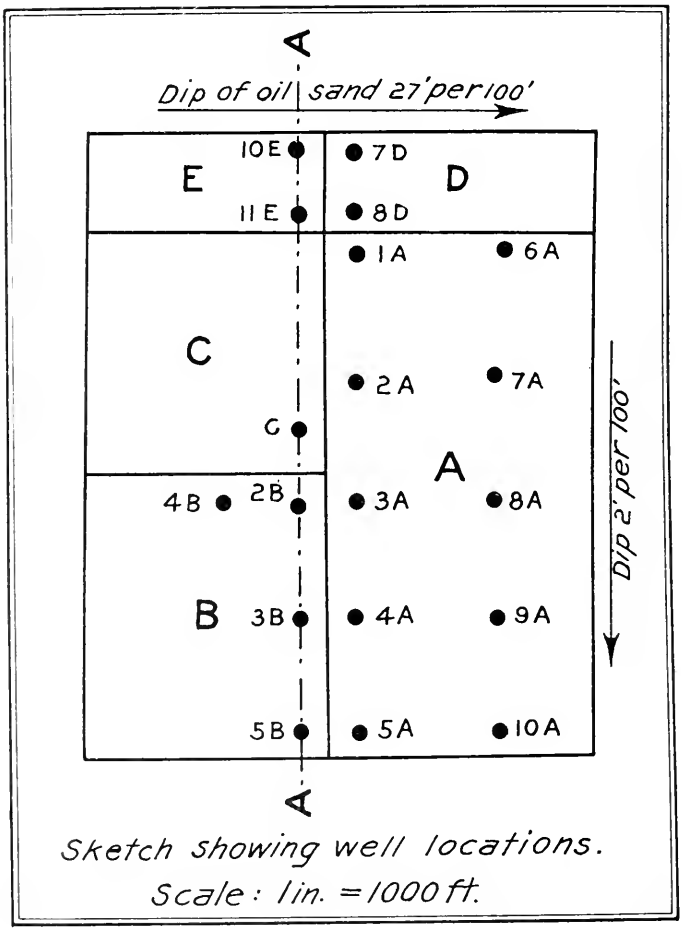
Future blank forms will carry a column for recording the depth at which the pump is working. A shallow pump depth may simply skim clean oil from a wet well.

Any officer of the bureau will be pleased to explain to any operator what is desired in filling out this report.

METHOD OF USING PRODUCTION RECORDS.

As there are many operators who do not realize the importance of production records, and seem to consider them merely as official red tape, it may be well to give an example of how they are used and what they show. The figures are from reports of wells in the Coalinga Field, situated as shown in the following map (Fig. 16), which also shows the dip of the oil-bearing sands.

Figure 16



All of the wells were drilled several years before the period covered by these figures. Some of the dates and figures have been slightly changed from those shown in the original reports, so that it is possible to show the use of records with a limited number of wells and figures. There are, of course, many factors which influence the production of wells, which do not show on a production report, such as their physical condition, and these factors must be taken into consideration when dealing with any given problem.

The figures appearing on the regular monthly production reports show the total amounts of oil and water produced and the number of days the wells pumped, as follows:

TABLE A.

Production Records Taken From the Monthly Production Reports.

Month	Well No. 1c				Well No. 2b			
	Barrels of clean oil	Barrels of water	Percentage of water	Number days well produced	Barrels of clean oil	Barrels of water	Percentage of water	Number days well produced
August	2,760	240	8.0	31	3,174	26	0.8	31
September	2,659	341	11.0	30	2,754	23	0.8	29
October	1,020	688	40.0	31	2,290	0	0.0	26
November	145	2,755	95.0	30	2,680	0	0.0	30
December	*	*	*	0	2,836	95	3.2	30
January	*	*	*	0	990	810	45.0	30
February	*	*	*	0	228	2,052	90.0	27
March	0	2,700	100.0	27	250	2,250	90.0	31
April	†	†	†	0	150	2,850	95.0	30
May	†	†	†	0	*	*	*	0
June	†	†	†	0	160	2,996	95.0	28

*Redrilling. †Shut down.

TABLE A—Continued.

Production Records Taken From the Monthly Production Reports.

Month	Well No. 3b				Well No. 4b			
	Barrels of clean oil	Barrels of water	Percentage of water	Number days well produced	Barrels of clean oil	Barrels of water	Percentage of water	Number days well produced
August	3,850	268	6.5	31	3,550	1	0.0	31
September	2,290	126	5.2	28	3,320	0	0.0	30
October	2,340	87	3.6	30	3,820	0	0.0	31
November	2,600	72	3.0	30	3,336	34	1.0	30
December	2,806	94	3.2	29	3,285	81	2.4	30
January	2,340	110	4.4	31	2,606	918	26.0	29
February	1,680	420	20.0	28	430	157	30.0	6
March	480	1,920	80.0	27	600	3,400	85.0	27
April	708	2,496	78.0	30	255	3,470	93.2	30
May	260	3,150	90.0	31	257	3,413	93.0	31
June	180	3,220	95.0	29	*	*	*	0

*Redrilling.

TABLE A—Continued.

Production Records Taken From the Monthly Production Reports.

Month	Well No. 3a				Well No. 2a			
	Barrels of clean oil	Barrels of water	Percentage of water	Number days well produced	Barrels of clean oil	Barrels of water	Percentage of water	Number days well produced
August	3,360	34	1.0	31	1,600	0	0.0	30
September	3,270	33	1.0	29	1,530	0	0.0	30
October	3,484	16	0.5	30	1,687	17	1.0	31
November	3,075	25	0.8	31	1,389	11	0.8	30
December	2,955	45	1.5	30	1,360	10	0.7	30
January	3,458	42	1.2	28	1,096	4	0.4	28
February	2,310	990	30.0	24	988	12	1.2	28
March	760	3,040	80.0	30	1,452	18	1.3	31
April	*	*	*	0	1,503	167	10.0	29
May	*	*	*	0	375	695	65.0	26
June	465	2,365	85.0	20	330	770	70.0	27

*Redrilling. †Shut down.

The figures when reduced to a common basis of daily production of oil are as follows:

TABLE B.

Average Daily Production of Oil and Water, in Barrels, for Each Producing Day During the Month.

Month	Well No. 1c			Well No. 2b			Well No. 3b		
	Oil	Water	Total fluid	Oil	Water	Total fluid	Oil	Water	Total fluid
August	89.0	7.7	96.7	102.0	0.9	102.9	124.2	0.0	124.2
September	80.8	11.3	92.1	95.0	0.8	95.8	81.8	4.5	86.3
October	32.9	21.9	54.8	82.0	0.0	82.0	70.8	2.9	73.7
November	4.8	90.2	95.0	89.3	0.0	89.3	80.9	2.6	83.5
December	*	*	0.0	94.5	3.0	97.5	96.7	3.2	99.9
January	*	*	0.0	33.0	27.0	60.0	75.5	3.6	79.1
February	*	*	0.0	8.4	76.0	84.4	60.0	15.0	75.0
March	*	100.0	100.0	8.1	72.6	80.7	17.8	71.0	88.8
April	†	†	0.0	5.0	93.0	98.0	23.6	83.2	106.8
May	†	†	0.0	*	*	0.0	8.4	104.0	112.4
June	†	†	0.0	5.7	107.0	112.7	6.2	111.0	117.2

*Redrilling. †Shut down.

TABLE B—Continued.

Average Daily Production of Oil and Water, in Barrels, for Each Producing Day During the Month.

Month	Well No. 4b			Well No. 3a			Well No. 2a		
	Oil	Water	Total fluid	Oil	Water	Total fluid	Oil	Water	Total fluid
August	114.5	0.0	114.5	108.3	1.0	109.3	53.3	0.0	53.3
September	110.6	0.0	110.6	113.0	1.0	114.0	51.0	0.0	51.0
October	123.0	0.0	123.0	116.1	0.5	116.6	54.4	0.5	54.9
November	111.2	1.1	112.3	99.2	1.0	100.2	46.3	0.3	46.6
December	109.6	2.6	112.2	98.5	1.5	100.0	45.3	0.3	45.6
January	90.0	31.6	121.6	123.5	1.5	125.0	39.1	0.1	39.2
February	71.7	26.1	97.8	96.2	41.2	137.4	35.3	0.4	35.7
March	29.6	103.0	132.6	25.3	101.3	126.6	47.0	0.6	47.6
April	8.0	115.0	123.0	*	*	0.0	51.8	5.7	57.5
May	8.0	110.0	118.0	*	*	0.0	14.4	26.7	41.1
June	*	*	0.0	23.2	131.0	154.2	12.2	28.1	40.3

*Redrilling.

A careful study of the above figures would reveal many striking features, but in order to most clearly bring out their meaning, diagrams are necessary. The diagrams here presented (Figs. 17 and 18) are almost self-explanatory and show that well 1 C was the first in the group to produce water, which quickly increased in amount, accompanied by an equally rapid decrease in the amount of oil. It will be noted that the other wells in the group later followed a similar course. This indicates that well 1 C is the source of the water trouble.

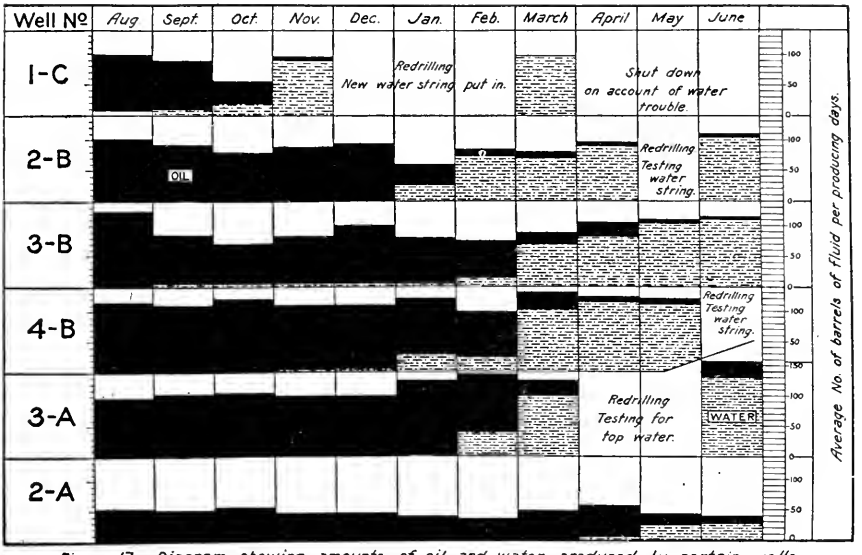


Figure 17 – Diagram showing amounts of oil and water produced by certain wells.

Diagrams based only on the water percentage, such as Fig. 18, can be more easily made and sometimes are sufficient to point out the origin of trouble. However, such a diagram might be misleading, for the reason that a well reporting high percentage of water, but making only a small amount of oil, would be given equal prominence on the diagram with a more productive well. It will be readily seen that figures of percentage mean but little unless accompanied by another basic figure

which shows the true volume of water. The percentage of water in the wells under consideration shows as follows in a diagram:

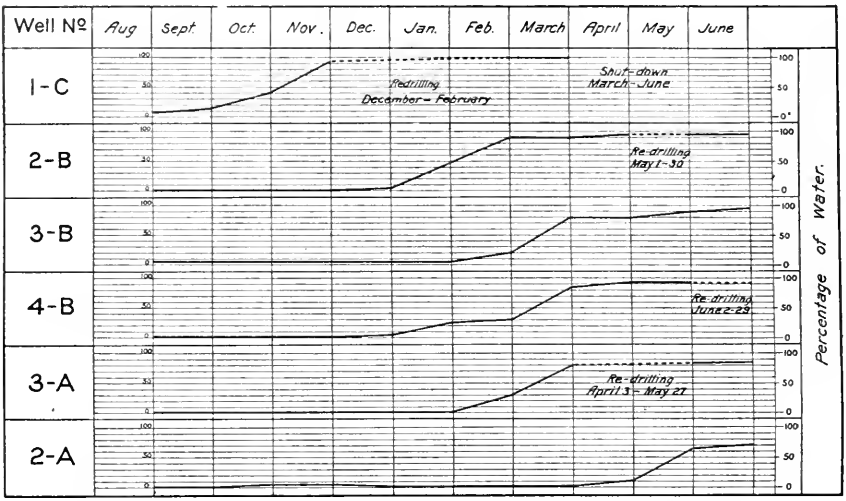
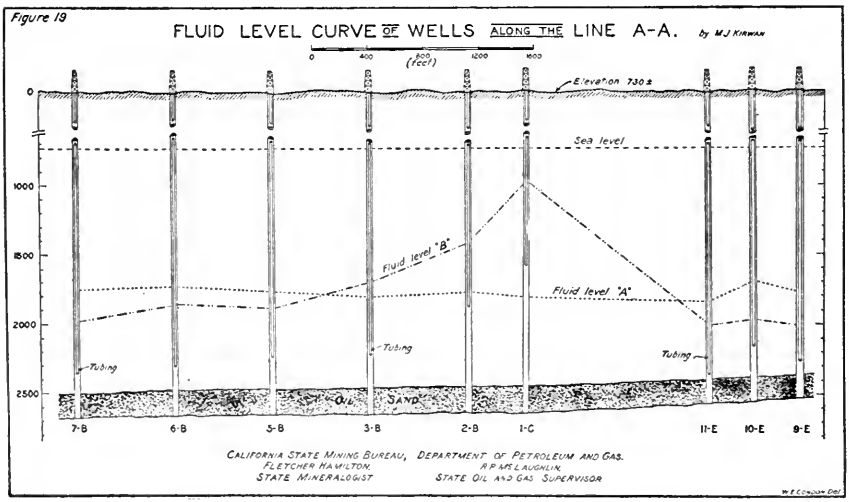


Figure 18 – Diagram showing percentages of water produced by certain wells.

FLUID LEVEL IN WELLS.

The usefulness of recording and comparing the levels to which fluid rises in wells at various times is excellently shown by some of these same wells. The following drawing (Fig. 19) is a cross section or profile through some of the wells. The dotted line shows the levels at which the fluid stood in the various wells before water trouble developed, while the solid line shows the levels about a year later, when the water trouble was serious. It will be noted that the high fluid level in well 1 C points to it as being the source of the water trouble. This is the same conclusion afforded by the figures on production.



NOTICE OF PROPOSED OPERATIONS.

In order to comply with the law, operators are required to notify the bureau of all proposed work. The following blanks cover all the requirements and will be furnished to all operators:

CALIFORNIA STATE MINING BUREAU

Department of Petroleum and Gas

Notice of Intention to Drill New Well

This notice must be given before drilling begins

_____Cal._____191__

Mr._____

Deputy State Oil and Gas Supervisor

_____Cal.

DEAR SIR:

In compliance with Section 17, Chapter 718, Statutes of 1915, notice is hereby given that it is our intention to commence the work of drilling well number_____Section_____ T._____ R._____, _____B. & M., _____ Oil Field,_____ County

The well is_____feet N. or S., and_____feet E. or W. from_____
(Give location in distance from section corners or other corners of legal subdivision)

The elevation of the derrick floor above sea level is_____feet.

We propose to use the following strings of casing either cementing or landing them as here indicated:

Size of Casing, Inches	Weight, Lbs. Per Foot	New or Second Hand	Depth	Landed or Cemented

It is understood that if changes in this plan become necessary we are to notify you if possible before cementing or landing the casing.

We estimate that productive oil or gas sand should be encountered at a depth of about_____feet, more or less

Respectfully yours.

_____
(Name of Company or Operator)

By_____

Address notice to Deputy State Oil and Gas Supervisor in charge of district where well is located

CALIFORNIA STATE MINING BUREAU

Department of Petroleum and Gas

Notice of Test of Water Shut-off

This notice must be given at least five days before the test, and a longer time is desirable

---Cal.----191--

Mr.----

Deputy State Oil and Gas Supervisor

----Cal.

DEAR SIR:

In compliance with Section 19, Chapter 718, Statutes of 1915, notice is hereby given that it is our intention to test the shut-off of water in well number----Section----T.----R.----, ----B. & M., ----Oil Field, ----County, on the----day of----191--.

----inch casing was {landed / cemented} in----(Formation) at----(Depth) on----(Date) 191--

----sacks of cement was used.

The----method was used in placing the cement.

Fluid level will be bailed to a depth of----feet and left undisturbed for at least 12 hours before your inspection.

The well is----feet deep. There {is / is not} a plug or bridge from----feet to----feet.

Respectfully yours,

(Name of Company or Operator)

By----

Address notice to Deputy State Oil and Gas Supervisor in charge of district where well is located

CALIFORNIA STATE MINING BUREAU

DEPARTMENT OF PETROLEUM AND GAS

Notice of Intention to Deepen, Redrill, Plug or Alter Casing in Well

This notice must be given fifteen days before work begins when possible

----------Cal.----------191---

Mr.----------

Deputy State Oil and Gas Supervisor

----------Cal.

DEAR SIR:

In compliance with Section 17, Chapter 718, Statutes of 1915, notice is hereby given that it is our intention to commence the work of deepening, redrilling, plugging or altering casing at well number----------
(Cross out unnecessary words)

Section----------T.----------R.----------, ----------B. & M., ----------Oil Field,

----------County.

The present condition of the well is as follows:

The proposed work is as follows:

Respectfully yours,

(Name of Company or Operator)

By----------

Address notice to Deputy State Oil and Gas Supervisor in charge of district where well is located

3—36639

Form 108 19215—1-17-15—5000

California State Mining Bureau

Department of Petroleum and Gas

Notice of Intention to Abandon Well

This notice must be given at least fifteen days before work is to begin

---

_____Cal._____191_.

Mr._____

Deputy State Oil and Gas Supervisor

_____Cal.

DEAR SIR:

In compliance with Section 16, Chapter 718, Statutes of 1915, notice is hereby given that it is our intention to abandon well number_____Section_____T._____ R._____, _____Oil Field_____County, commencing work on the_____day of_____191__.

The present condition of the well is as follows:

The proposed work is as follows:

Respectfully yours,

_____
(Name of Company or Operator)

By_____

Address notice to Deputy State Oil and Gas Supervisor in charge of district where well is located

CALIFORNIA STATE MINING BUREAU

Department of Petroleum and Gas

SUPPLEMENTARY NOTICE

.....Cal.,.....191..

Mr.....

Deputy State Oil and Gas Supervisor

.....Cal

DEAR SIR

Please be advised that our notice to you dated..... 191.. stating our intention

to.....well number.....Section.....T .....R.....B & M.
(Drill, deepen, redrill, test abandon)

.....Oil Field, ...County

must be amended on account of changed or recently discovered conditions

The new conditions are as follows:

We now propose

Respectfully yours,

.....
(Name of Company)

By.....

NECESSITY OF GEOLOGICAL AND ENGINEERING WORK.

While discussing the importance of systematic work and its value to the oil operators themselves, entirely aside from legal requirements of this department, it may be well to explain the functions of an engineer or geologist, which seem to be understood by comparatively few oil men.

At the present time, fortunately, it is not necessary to point out the usefulness of a geologist in choosing new or prospective oil lands. Most operators of importance now realize that systematic study of earth conditions, by a specially trained man, is a better method to pursue in planning investment of money, than to merely spend it on incomplete information and then plan how to recover it. Consequently, geologists are usually employed before drilling begins. However, there are too few companies who realize the importance of continuing to properly use the services of a geologist or engineer after the land has been selected and development commenced.

The larger operators, of which there are possibly a dozen in California, will particularly benefit by considering this question. Possibly the small and comparatively inactive concerns would not be justified in the expense of attempting to individually make use of such work, but several such companies could profitably join in employing a competent engineer.

It must be clearly borne in mind that the work of this bureau covers only the prevention or repair of damage. The bureau has neither the facilities nor inclination to direct the management of private properties. It will, however, assist operators, whenever it is possible, to solve their problems.

INEFFICIENCY IN OIL FIELD OPERATIONS.

The work of the bureau is not directed to a study of operating conditions, but observation of them could not well escape notice, while the regular work was being carried on. In fact, a most excellent opportunity is afforded to compare various methods. This broad field of observation justifies the statement that there is probably no large business so inefficiently conducted as is that involved in the production of oil in California, notwithstanding the fact that mechanical operations here seem to be more advanced and improved than in any other part of the world. The annual losses, due to unsystematic work and actually paid out of pocket, amount to hundreds of thousands of dollars. Bankruptcy would speedily follow such management in any line of business not dependent upon either a most abundant natural supply of crude material or fresh infusions of capital from other sources. These two alleviating conditions can not be expected to continue indefinitely.

The producing branch of the oil business is, of course, all important, because all other branches of the business depend directly on it. It will be clearly realized, by any reasoning person, that to economically extract oil from its natural underground reservoirs requires the most complete knowledge possible on two subjects: First, the natural or geological conditions governing the creation and preservation of the reservoirs, and, second, the artificial or mechanical conditions created near the reservoir by efforts to drill wells and extract the oil. There is absolutely no other way of utilizing the necessary knowledge than by placing the sole responsibility of outlining and directing all development work in the hands of men who possess such knowledge. The solution of the problem, to use other words, requires engineering skill. Such a statement is not theoretical or visionary, and its correctness is proved by the consideration of other and similar industries, such as the mining of the important metals, in which development work is directed as an engineering problem. Further proof that twentieth century methods, using technical skill, are applicable to the oil-producing business, is furnished by the fact that several of the largest companies in California, shown on pages 9 and 10, are employing such a system.

There has been a hazy notion among oil operators of the value of the geological information, and numerous concerns have made an effort to collect it but have stopped short when it came to applying it. The bureau has frequently had most elaborate and expensive geological data presented to it in the form of records, only to find, on pursuit of an inquiry, that the so-called geological department of a company had no knowledge as to whether the so-called operating departments had followed the preliminary suggestions and, furthermore, had no knowledge of facts subsequently developed by drilling operations. The inefficiency was found to not simply end with the disclosure that the operating departments had no knowledge of the preliminary work of the geological departments, but really had no connected knowledge or records of their own drilling work.

A single example, chosen at random from numerous cases, may be used to illustrate the results of such lack of system. A well costing about $50,000 developed water trouble and had never been a satisfactory producer. The supposedly complete record of the well, as furnished to the bureau by the owners, simply showed that a string of casing had been properly cemented below the water sand and above the oil sand. The owners had no definite opinion as to the cause of the trouble, and even expressed an inclination to plug and abandon the well, charging the expense of drilling the well to profit and loss.

Further inquiry by the bureau caused a more extended search for records kept by owners, and developed the fact that several hundred

feet of casing had been lost during drilling operations and was left in such a position that it might form an almost ideal channel through which the overlying water might descend to the oil-bearing formation. Notwithstanding the amount of money invested in the well, there had apparently been no steps taken to either demonstrate or disprove such a possibility. This particular well may, of course, be repaired under the direction of the bureau, but it seems almost incredible that a large company, merely seeking profit from its invested money, could have allowed such a condition to arise and exist for several years. The employment of a competent engineer, authorized to gather all the facts and see that his recommendations were carried out, would prevent such wastefulness and relieve the superintendent of unjust criticism for not attending to details, which he could not possibly carry along with those of his routine work.

METHODS OF SHUTTING OFF WATER.

The following descriptions and statements relative to methods of shutting off water are written by several members of the bureau staff, namely, R. B. Moran, M. J. Kirwan, R. D. Bush and R. P. McLaughlin.

In most of the oil fields water is found in the formations overlying the oil sands. There are a number of methods in use for excluding this water from the wells. Local conditions must be taken into account in the choice of method used in any particular case. Shallow wells are often successfully handled by landing the casing in impervious strata, but in deep drilling in California in the majority of cases hydraulic cement is used.

Formation shut-off is the term applied to a shut-off where casing is landed in a bed of shale or clay without using cement or other device to plug the space between the casing and the wall of the hole. Much depends upon the kind of casing shoe which is used. It should be a plain shoe, as distinguished from the notched Baker shoe and from the types used in rotary drilling. A shoe 14″ to 20″ in length is usually used, although in a few cases in deep work shoes from 6″ to 20″ in length have been tried. It is important not to have the largest diameter of the shoe at the bottom, so that it can be driven tightly into the formation. When a suitable shale or clay is reached where it is desired to land the water string, the hole is drilled ahead with a smaller-sized bit and the casing is driven until the shoe is tight in the formation. This will prevent the water from following down the outside of the casing and entering the well.

At the first departure from the simple formation shut-off, clay and chopped rope were put into fill and seal up the space between the shoe and the wall. A practice in vogue before the use of the cement, but now obsolete, was to make a landing on a hard lens or "shell," as it

is usually termed, depending on a bag of flaxseed to seal up the space around the shoe. The hole was carefully trued up and cuttings removed, then the seed bag was lowered into the hole and casing landed on it. The swelling of the seed upon taking up water was depended on to hold back the water long enough to allow the mud to settle and the formation close in enough to make a permanent job.

Tamping is a method which has been in use a number of years but which now has but few followers. A complicated expanding packer is put onto the oil string where it is desired to make a shut-off. This point, however, must also be below the next larger string of pipe. The packer is made of canvas and might be described as an inverted umbrella. Sand and pulverized shale is then run in between the casings by means of a stream of water. The outer string must be moved up and down all the time, both for the purpose of keeping the material introduced moving down to the bottom of the hole and for the purpose of tamping it tight around the shoe. As the space below fills up, the tamping string is removed joint by joint. This operation takes from three to six weeks. A few men advocating the practice claim that the casing recovered repays the labor involved. It is also evident that by this means a string of casings is saved, the last string serving as both the oil and water string. It is readily seen to be a process which would only be applicable in drilling where formations stand up sufficiently to allow the removal of casing at will. An interesting sidelight on conditions which are sometimes encountered is given by the statement that 70 cubic yards of *sand* were used in filling up a space behind a single 20″ length of 8″ pipe.

Hydraulic cement is now being generally used in California for excluding water from oil sands. What is called the "dump bailer" method is the simplest in use. The hole is first trued up and carefully cleared of cuttings in case the work is done at the bottom of the hole. If the hole has already been carried below the shut-off point it is necessary to put a bridge in, or, in other words, a false bottom in the hole. The casing is raised off the bottom. Thirty or forty sacks of cement, mixed to the consistency of thin gruel, are lowered to the bottom by means of the dump bailer. The casing is then filled with water to the top and a cap screwed on, then when the string is lowered to bottom, the cement is forced out behind the casing. Time is allowed for the cement to set, after which any that has been left in the hole is drilled out. If the displacements have been accurately figured this will leave only a few feet on the inside of the casing which gives little or no trouble in drilling out. One of the advantages of this method is the fact that where mud has been used in drilling, this mud can be left behind the casing. It is the usual practice in some fields to put in a

few barrels of clear water in advance of the cement, so as to give it a better chance to set without being mixed too much with mud. In experienced hands this method has scored a large percentage of successful shut-offs, even in deep territory. The amount of cement used is necessarily limited and consequently the method is applicable only to cases where there are no large cavities to be filled, such as often occur in redrilling or other troubles in wells.

The pumping in of cement by pressure pumps is the method in most general use. For this purpose complete outfits are mounted on auto trucks and steam connections are made with the boiler at the well. Two pumps are generally used. The work is generally started with a pump capable of delivering a pressure of 300 to 400 lbs. and finished with one capable of 700 to 800 lbs. The cement is mixed in a portable mixing trough. Neat cement is used and it is mixed to the consistency of thin gruel.

There are a number of variations as to the details of the method. In all cases it is important to true up the bottom of the hole and remove the cuttings. The casing is raised a few feet from the bottom, while the cement is being pumped, and then it is lowered to position after the cement is in place. Some operators circulate water prior to running in the cement until the clear water comes to the surface outside the casing. Others leave as much circulated mud in the hole as possible, only pumping in a small amount of clean water in advance of the cement in order to prevent the mud mixing with the cement, the idea being to leave this mud to settle around the casing and thus prevent the movement of waters from one stratum to another.

An early method, now little used, was to pump cement through tubing, a packer being placed at the bottom of the casing to prevent the return of the cement between the tubing and the casing. An improvement on this method, now extensively used, is to pump the cement through tubing which passes through a casing head, provided with a release and fitted to the top of the water string. The tubing is lowered to within a few feet of the casing shoe, the distance depending on the amount of cement it is desired to leave in the casing. Water is pumped in to get circulation outside the casing and then the casing head release is opened and the casing pumped full of water, which prevents the cement from coming up between the tubing and the casing and forces it outside the casing, when the release is closed. After the cement is in and displaced from the tubing with water, the casing is lowered in place and all connections closed until the cement has taken its initial set, to prevent a possible return of the cement around the shoe. There are two methods of determining when the cement has been displaced from the tubing. First, to calculate the capacity of the tubing and

measure the required amount of water; and second, to reduce the diameter of the lower end of the tubing with a swedge nipple. A wooden plug is then put in, after the cement and ahead of the displacing water. When the plug reaches the swedge nipple and the cement is out, the pump pressure jumps up and the circulation stops.

The majority of the operators now pump the cement directly into the casing and then displace it and force it out behind the pipe by filling it up with water. Some operators figure the contents of the casing and stop the pumps when the calculated amount of water has been pumped in. In some cases the water is measured with a meter, while others consider this too risky and measure the water in tanks, thus having the exact quantity at hand. One case came to our notice where it was discovered that the meter was not working after the cement had been pumped in. Water was then pumped in until the cement was returned to the surface outside the casing.

In another method two wooden plugs about three feet long are used. They are made to fit tightly against the casing by means of rubber belting. The plugs are introduced by means of special arrangements of gates and fittings. The first plug is started down the casing ahead of the cement to prevent the water and cement mixing. The original publication (Bulletin No. 73, p. 215) erroneously stated that "The casing is raised off the bottom high enough to allow this plug to pass clear out of the casing." The usual practice is to raise the casing about 18″ so that the upper portion of the first plug remains in the casing. Sometimes a wooden "spreader," 2″ x 4″ x 6′ to 15′ long is run in ahead of the second plug. This retains within the casing cement which has become excessively diluted and would otherwise rest at the critical position immediately around the shoe of the casing. The plugs and "spreader" are easily drilled out. The second plug is introduced after the cement is pumped in and the casing lowered so that the plugs and "spreader" will not be passed out of the casing but come to rest and thus run up the pressure of the pumps when all the cement has left the casing. In using this process it is customary to measure the water pumped in behind the second plug as a check on its progress.

The amount of cement used varies from five to thirty tons, according to local conditions. On an ordinary job, without any complications resulting from caving, ten to fifteen tons are used. Most operators use larger quantities than would be needed, for the simple purpose of plugging off water behind the shoes, because it serves to reinforce the casing by filling the space between the casing and the wall and also prevents corrosion from mineral waters. It is not uncommon to find in redrilling or abandonment of wells where large amounts of cement have been used, that the cement has followed up the casing as much as 1000

feet. In a few cases where formations showed decided tendency to collapse casing in completed wells, as much as thirty tons have been used in the hope of holding back the walls and preventing this collapse.

The shutting off of "bottom water" is a different problem, and usually a much more difficult one than presents itself in shutting off "top water." Oil sands have been drilled through and the operator often has to contend with gas, loose sand, sidetracked or slivered casing. The hole must first be cleaned out and, if any casing was left in when the oil string was pulled, it must be shattered with dynamite and plugged up above the water sand. Some operators have been successful by putting in rope, brick, etc., and tamping down thoroughly with the tools and on top of that, as a foundation, tamping down a mixture of cement and lathe cuttings put in dry in tin cartridges. These are broken up and the cement mixed with water in the hole by the tools. Others have been successful, simply dumping in neat cement with a dump bailer, up to the bottom of the lowest oil sands.

Probably the best method, and the one that has met with success under the most difficult conditions, is by pumping the cement through tubing, which enables the operator to put it under pressure and force it out into cavities and channels that would not otherwise be filled with cement. The outfit is similar to that described above for cementing a water string with the tubing and casing head, and in addition the space between the oil and water string is packed off at the top of the water string, thus preventing the cement from coming up between these two casings, and is so constructed as to allow the movement of the oil string through it if that is desired. In using this method it frequently happens that the oil sands above will absorb considerable water, and continue to do so until the cement comes up and shuts this off to some extent, causing the pump pressure to rise and forcing the cement into the formation below. Thus the oil sands become somewhat deadened and it may be some time before the former production is obtained from these sands; however, it is not believed that the cement forms a solid wall around the casing in the oil sands, which would shut out all the oil, for the reason that there is sufficient gas and movement of the cement to keep it from setting. Some operators advocate mudding up the oil sands first, in order to keep the cement out and prevent circulation, but this would, no doubt, prevent the return of the oil to a greater extent than the cement.

The most difficult problem the operators have to deal with is the case of a water sand between oil sands, where it is desired to produce from the lower oil sand and give the upper oil sand the proper protection from water. In many cases this would require two additional strings of casing, generally reducing the diameter of the hole, in some cases to

an impracticable size, the original oil string being cemented above the water sand, one additional being cemented below the water sand, and one additional for the new oil string. One operator in the Coalinga field successfully solved this problem in one well with one string of casing, giving the lower sand a test, which, however, proved nonproductive. The original oil string was cemented below the water sand, enough cement being put in to go above the water sand, and cement the casing in the overlying shale. The lower oil sand was bailed dry and later that portion of the hole below and a few feet up into the water string was plugged up with cement. Then the casing opposite the upper oil sands was perforated and tests proved that these oil sands were free from water.

AMOUNT OF CEMENT NECESSARY.

The amount of cement required to fill certain spaces in an oil well should be approximately known when a job is commenced and the following table, where the space is exactly stated, can be used for such a purpose. In actual practice the exact cavity may not be known. The table is based on the fact that a sack of cement, weighing about 100 pounds, will occupy about 1.1 cubic feet after being mixed with water and allowed to set.

Lineal Fee Filled by One Sack of Portland Cement Alongside of Oil-Well Casings.

(One sack equals 1.1 cubic feet neat cement when set.)

Size of casing		Diameter of well (excess over casing diameter)					
Normal	Actual outside diameter	One inch	Two inches	Three inches	Four inches	Five inches	Six inches
	Inches.	*Feet.*	*Feet.*	*Feet.*	*Feet.*	*Feet.*	*Feet.*
4¼-inch	4.75	19.2	8.8	5.4	3.7	2.8	2.2
4½-inch	5.00	18.3	8.4	5.2	3.6	2.7	2.1
5⅝-inch	6.00	15.5	7.1	4.4	3.2	2.4	1.9
6⅝-inch	6.625	14.2	6.6	4.2	2.9	2.2	1.7
6¼-inch	7.00	13.5	6.3	4.0	2.8	2.1	1.7
7⅝-inch	8.00	11.9	5.6	3.5	2.5	1.9	1.5
8⅝-inch	8.625	11.2	5.2	3.3	2.4	1.8	1.4
9⅝-inch	10.00	9.7	4.6	2.9	2.1	1.6	1.3
10 -inch	10.75	9.0	4.3	2.8	2.0	1.5	1.2
11¾-inch	12.00	8.1	3.9	2.5	1.8	1.4	1.1
12½-inch	13.00	7.5	3.6	2.3	1.7	1.3	1.0
13½-inch	14.00	7.0	3.4	2.2	1.6	1.2	1.0
15½-inch	16.00	6.1	3.0	1.9	1.4	1.1	0.9

MUD LADEN FLUID METHOD.

The term "mud laden fluid" herein used applies to a mixture of clay with water, the water carrying the finely divided clay in suspension in quantities varying from 5 to 25 per cent.

Mud laden fluid has been commonly used in rotary drilling and with the use of a circulator system has been mainly to "mud-off" formations which do not stand up well, and cave in in such a manner as to "freeze up" the casing. Mud laden fluid has also been successfully used in mudding off gas formations. The mud laden fluid method for shutting off water is comparatively new in California fields and has not been sufficiently demonstrated to receive the wholesale approval of this department. This mud fluid process should be tried only on wells favorable for demonstrating its success or failure, and in general on wells which are not line wells unless agreeable to the neighbors concerned.

In connection with the foregoing discussion of the practice of shutting off water by the mudding process it is evident that this method should be tried in simple cases only, such as top water, until such time as the method has been thoroughly demonstrated. In case this method is applied to wells where a water sand lies between the oil sands, the adjoining wells should be free from water so as to indicate, by their production, the success or failure of the experiment. Wells should be cemented where the mud process is tried in redrilled or old wells where the formation is not suitable for a formation shut off with a long shoe.

The process may reasonably be presumed to accomplish several things greatly to be desired in California, especially a reduction in cost of drilling wells. However, as the State Mining Bureau is engaged in practical work, theory can not be the sole recommendation of this or any other problem. Doubtless some operators will be more than willing to immediately use the mud fluid method of shutting off water as it will be much less expensive than the ordinary methods now in use.

It is recommended that a limited number of wells be permitted to drill with the mud fluid process in selected localities where the after effects can be definitely studied, and if necessary, corrected without undue injury to surrounding property. The work should be allowed to proceed only under definite specifications to be furnished by the State Mining Bureau, which welcomes suggestions as to the specifications.

SPECIFICATIONS FOR DRILLING WITH MUD.

The following specifications are presented with the understanding that we do not believe them to be incapable of improvement. The bureau welcomes the introduction of new methods and will gladly confer with any operator on such questions.

(1) The work must at all times be open to the inspection of all operators owning land or operating wells within one mile of the well, and any reasonable information as to the operations must be furnished them.

(2) The mud must be entirely free from sand or grit.

(3) Constant circulation of mud must be maintained during operations until casing is ready to land. Just before the casing is landed the exit of mud from the well must be stopped and pumping continued at a pressure of five hundred pounds per square inch until no more mud can be pumped into the well. After the casing is landed the level of the mud behind it must be kept permanently at the ground surface.

(4) The casing must be landed in some thick bed of sticky clay. Before landing the casing, a hole two inches smaller in diameter than the shoe must be drilled at least three feet below the larger hole.

(5) A casing shoe not less than three feet long must be used. The outside diameter at the point of the shoe must not be larger than at any point above.

(6) Proof will be required that the casing is securely and tightly landed. The well must be drilled at least five feet below the shoe, bailed dry and allowed to stand at least twenty-four hours.

COLLAPSING STRENGTH OF STEEL CASING.

The question of strength of casing to resist collapse is of vital importance to oil operators contemplating deep wells because it must be remembered that after the well is completed it will some times stand nearly empty and therefore the casing will be subject to the maximum pressure of the column of water outside it. Casing which is too light is the poorest kind of false economy.

When a test of the water shut-off is made at a well by the Petroleum Department of the State Mining Bureau, it is desirable to bail the well down as far as is safe, and the accompanying table showing the strength of various sizes and weights of casing is presented as a rough guide. The list is based on a great number of actual tests conducted by Prof. Reid T. Stewart (Vol. 27, Transactions American Society of Mechanical Engineers), and the figures for depth of water exerting pressure enough to collapse casing is the limit beyond which safe operations would not extend. A prudent operator would stop far short of the limit. It must be remembered that in this list no account is taken of such underground forces as are sometimes reported to have cut off and carried casing to one side and out of reach of the drilling tools. It should be further remembered that when any force is suddenly applied it is much more destructive than when gradually applied, and if a well were suddenly emptied of its fluid content, as in the case of a gas blow-out, the casing might fail under a water pressure that could have been supported if the well were emptied slowly by a bailer or pump. The depth of water is of course sometimes much less than the depth of the well and it is important to always note the level of the fluid which will stand outside of the casing.

Care of casing before it is used is of vital importance. Tests show that when the casing is slightly flattened, or out of round, failure takes place most easily. In handling casing it is frequently allowed to fall and become bruised or dented, thereby inviting collapse when it is later used in a well.

Size of casing (nominal)	Weight per foot, pounds (nominal)	Collapsing strength, pounds per square inch	Depth of water exerting pressure enough to collapse casing (feet)
4¼-inch	16	4,715	10,880
4½-inch	13	2,900	6,700
4½-inch	15	3,605	8,320
5⅝-inch	20	3,295	7,620
6⅝-inch	20	2,345	5,420
6¼-inch	24	3,215	7,420
6½-inch	26	3,650	8,420
6½-inch	28	4,080	9,420
6⅝-inch	20	1,980	4,570
6⅝-inch	26	3,075	7,080
6⅝-inch	28	3,490	8,060
6⅝-inch	30	3,850	8,900
7⅝-inch	26	1,945	4,480
8¼-inch	28	1,660	3,840
8¼-inch	32	2,150	4,960
8½-inch	36	2,635	6,080
8¾-inch	38	2,880	6,640
8¾-inch	43	3,510	8,100
9⅝-inch	33	1,285	2,970
10 -inch	40	1,425	3,290
10 -inch	45	1,795	4,140
10 -inch	48	2,025	4,680
10 -inch	54	2,510	5,800
11 -inch	47	1,375	3,175
11 -inch	60	2,215	5,100
11⅝-inch	40	835	1,930
12½-inch	40	500	1,150
12¾-inch	45	750	1,730
12¾-inch	50	1,010	2,330
12¾-inch	54	1,215	2,800
12¾-inch	50	650	1,560
15⅝-inch	70	795	1,840

Table Showing Capacity of Tubing, per Lineal Foot, in Gallons and Cubic Feet.

Nominal inside diameter	Weight per foot, pounds	Actual outside diameter, inches	Actual inside diameter, inches	Capacity per foot	
				Gallons	Cubic feet
1¼-inch	2.24	1.660	1.390	.079	.0105
1½-inch	2.68	1.900	1.622	.1078	.0144
2 -inch	4.00	2.375	2.021	.1661	.0222
2 -inch	4.50	2.375	1.971	.1582	.0212
2½-inch	5.74	2.875	2.461	.2470	.0330
2½-inch	6.25	2.875	2.433	.2420	.0323
3 -inch	7.54	3.500	3.080	.3870	.5180
3 -inch	8.50	3.500	3.018	.3720	.0497
3 -inch	10.00	3.500	2.914	.3460	.0463
3½-inch	9.00	4.000	3.558	.5160	.0689
4 -inch	10.66	4.500	4.022	.6300	.0882
4 -inch	11.75	4.500	3.980	.6510	.0870

Table Showing Capacity of Casing, per Lineal Foot, in Gallons and Cubic Feet.

4¼-inch	16.00	4.750	4.082	.680	.091
4½-inch	12.85	5.000	4.506	.830	.116
4½-inch	15.00	5.000	4.424	.799	.107
5⅝-inch	20.00	6.000	5.352	1.170	.156
6¼-inch	20.00	6.625	6.049	1.490	.199
6¼-inch	24.00	6.625	5.921	1.430	.191
6¼-inch	26.00	6.625	5.855	1.400	.187
6¼-inch	28.00	6.625	5.791	1.365	.182
6⅝-inch	20.00	7.000	6.456	1.700	.227
6⅝-inch	26.00	7.000	6.276	1.610	.215
6⅝-inch	28.00	7.000	6.214	1.580	.211
6⅝-inch	30.00	7.000	6.154	1.546	.206
7⅝-inch	26.00	8.000	7.386	2.224	.296
8¼-inch	28.00	8.625	8.017	2.625	.350
8¼-inch	32.00	8.625	7.921	2.560	.343
8¼-inch	36.00	8.625	7.825	2.500	.334
8¼-inch	38.00	8.625	7.775	2.470	.330
8¼-inch	43.00	8.625	7.651	2.390	.320
9⅝-inch	33.00	10.000	9.384	3.600	.480
10 -inch	40.00	10.750	10.054	4.130	.552
10 -inch	45.00	10.750	9.960	4.060	.543
10 -inch	48.00	10.750	9.902	4.020	.537
10 -inch	54.00	10.750	9.784	3.900	.522
11⅝-inch	40.00	12.000	11.384	5.290	.706
12¼-inch	40.00	13.000	12.438	6.300	.843
12½-inch	45.00	13.000	12.360	6.230	.834
12½-inch	50.00	13.000	12.282	6.140	.821
12½-inch	54.00	13.000	12.220	6.090	.814
13⅜-inch	50.00	14.000	13.344	7.280	.973
15½-inch	70.00	16.000	15.198	9.420	1.260

STATISTICS OF OIL PRODUCTION.

The statistics of oil and gas production, together with financial results of the industry, for the calendar year 1916, are fully set forth in Bulletin No. 74, of this bureau.

Monthly statistics for various fields and for the entire state are here given for the purpose of bringing records previously published in Bulletins Nos. 69 and 73 down to date. The figures in uniformity with previous publications are those collected by the Standard Oil Company.

They closely check those published by the Independent Oil Produeers Agency and also the figures collected by this department in the form of sworn statements.

KERN RIVER.

	Number of wells		Average daily production in barrels	
	Producing	Completed	Total	Per well
1916—July	1,838	12	22,280	12.1
August	1,838	8	22,550	12.3
September	1,859	13	22,600	12.2
October	1,886	9	23,075	12.2
November	1,900	13	22,595	11.9
December	1,908	8	22,495	11.8
1917—January	1,927	5	23,645	12.3
February	1,935	4	24,410	12.6
March	1,946	6	24,445	12.5
April	1,953	2	23,875	12.2
May	1,954	3	23,595	12.1
June	1,955	5	23,030	11.8

McKITTRICK FIELD.

	Number of wells		Average daily production in barrels	
	Producing	Completed	Total	Per well
1916—July	288	3	9,504	33.0
August	290		8,876	30.6
September	290	1	9,650	33.3
October	292	2	9,502	32.6
November	294	1	9,582	32.6
December	293	3	8,812	30.1
1917—January	290	2	9,278	32.0
February	290	2	8,678	29.9
March	293	2	9,308	31.8
April	298	2	9,596	32.2
May	301	3	9,185	30.5
June	302	2	9,069	30.0

MIDWAY-SUNSET.

	Number of wells		Average daily production in barrels	
	Producing	Completed	Total	Per well
1916—July	1,592	22	107,624	67.5
August	1,622	18	108,280	66.8
September	1,659	20	111,988	67.5
October	1,682	14	112,635	66.9
November	1,693	19	108,327	64.0
December	1,710	19	102,217	59.9
1917—January	1,713	28	101,503	59.3
February	1,742	16	100,980	57.9
March	1,762	21	100,789	57.1
April	1,781	38	101,723	57.1
May	1,814	23	99,832	55.0
June	1,842	19	99,543	54.1

LOST HILLS AND BELRIDGE.

	Number of wells		Average daily production in barrels	
	Producing	Completed	Total	Per well
1916—July	297	10	13,239	44.6
August	302	14	14,155	46.8
September	319	14	14,232	44.6
October	336	8	14,820	44.1
November	342	10	14,754	43.1
December	350	9	14,719	42.1
1917—January	359	6	14,807	41.3
February	365	12	15,729	43.1
March	376	18	16,803	44.7
April	392	9	17,394	44.4
May	398	3	17,010	42.8
June	412	12	17,453	42.4

COALINGA.

	Number of wells		Average daily production in barrels	
	Producing	Completed	Total	Per well
1916—July	903	5	43,627	48.3
August	914	2	43,615	47.7
September	925	5	44,052	47.6
October	935	4	44,052	47.2
November	927	1	44,291	47.8
December	949	5	43,215	45.5
1917—January	939	4	42,683	45.5
February	941	5	42,486	45.0
March	942	10	42,962	45.5
April	961	7	46,841	48.7
May	982	8	44,644	45.5
June	988	7	42,192	42.7

LOMPOC AND SANTA MARIA.

	Number of wells		Average daily production in barrels	
	Producing	Completed	Total	Per well
1916—July	239	----------	12,895	53.9
August	235	2	12,705	54.1
September	244	1	12,330	50.5
October	248	----------	12,850	51.8
November	248	----------	13,075	52.7
December	249	1	12,890	51.7
1917—January	250	5	13,370	52.5
February	254	5	13,865	54.5
March	259	2	14,509	56.0
April	256	3	14,575	56.9
May	258	3	14,300	55.4
June	258	4	15,680	60.7

VENTURA-NEWHALL.

	Number of wells		Average daily production in barrels	
	Producing	Completed	Total	Per well
1916—July	448	1	3,067	6.8
August	436	1	2,962	6.8
September	436	1	2,786	6.4
October	429	3	2,861	6.7
November	438		2,893	6.6
December	446	2	2,882	6.5
1917—January	449	2	2,868	6.4
February	444	3	2,986	6.7
March	446	1	2,998	6.7
April	458		2,923	6.4
May	452	3	3,051	6.7
June	454	5	3,414	7.5

LOS ANGELES AND SALT LAKE.

	Number of wells		Average daily production in barrels	
	Producing	Completed	Total	Per well
1916—July	675		4,782	7.1
August	675	1	4,439	6.6
September	674	1	4,483	6.6
October	675		4,417	6.5
November	675		4,654	6.9
December	674		4,396	6.5
1917—January	675		4,244	6.3
February	672		4,389	6.5
March	673		4,074	6.1
April	674		4,525	6.7
May	671		3,765	5.6
June	670		4,179	6.2

WHITTIER-FULLERTON.

	Number of wells		Average daily production in barrels	
	Producing	Completed	Total	Per well
1916—July	632	5	41,145	65.2
August	642	5	41,645	64.9
September	647	6	43,163	63.7
October	655	3	42,078	64.3
November	658	4	42,808	65.0
December	637	9	44,127	69.2
1917—January	661	5	49,251	74.5
February	667	7	48,775	72.0
March	672	1	47,455	70.6
April	674	2	47,403	70.4
May	676	4	45,392	67.1
June	679	5	44,184	65.0

SUMMERLAND.

	Number of wells		Average daily production in barrels	
	Producing	Completed	Total	Per well
1916—July	112		155	1.4
August	112		155	1.4
September	112		155	1.4
October	112		155	1.4
November	112		155	1.4
December	112		155	1.4
1917—January	112		155	1.4
February	112		155	1.4
March	112		155	1.4
April	112		155	1.4
May	112		155	1.4
June	112		155	1.4

WATSONVILLE.

	Number of wells		Average daily production in barrels	
	Producing	Completed	Total	Per well
1916—July	5		75	15.0
August	5		75	15.0
September	5		75	15.0
October	5		75	15.0
November	5		75	15.0
December	5		75	15.0
1917—January	5		75	15.0
February	5		75	15.0
March	5		75	15.0
April	5		75	15.0
May	5		75	15.0
June	5		75	15.0

GENERAL REGULATIONS FOR ORGANIZATION AND CONDUCT OF THE DEPARTMENT OF PETROLEUM AND GAS.

The system developed within the department of petroleum of the State Mining Bureau for the purpose of most effectively conducting its technical work may be of public interest in view of the foregoing statements showing the necessity of more technical work by large oil producing concerns. The following regulations have been developed by the supervisor during the past two years and are not presented as being perfect but rather with the idea that some features may be useful to other concerns carrying on similar work.

Successful administration of the law under which this department operates depends upon harmonious and intelligent action of all members of the department. These instructions are issued to members of the department for the purpose of outlining the plan upon which the department is organized and such regulations as are necessary. It is not intended to enforce uniformly mechanical operations. Each individual is expected to make suggestions, through regular channels, with the idea of improvement in our work. No member of the department is permitted to engage in private work, involving the oil business in California.

The supervisor is subordinate to the State Mineralogist, and attends to general questions such as the policy of the department in its relations to the public and with other public departments. He also covers intradepartmental matters affecting the various districts. All public reports and statements as well as formal orders are issued by the supervisor. Legal actions are started at the direction of the supervisor.

The chief deputy will, in the absence of the supervisor, or under special orders, perform the duties of the supervisor.

The deputy supervisors are responsible to the supervisor for all details of technical and adminnstrative work within their respective districts. Questions of general policy of doubtful problems will be referred to the supervisor.

It is essential that recommendations as to work at wells be made by a man on the ground and familiar with local conditions. Therefore the supervisor will not make recommendations on such operations until they have been passed on by the deputy. Reversal by the supervisor of a deputy's recommendation will only be made after careful review and discussion with the deputy and the party requesting the review.

The various districts are prescribed by law in such manner as to cover the entire state, but the deputies are required to confine their work to only those portions of their districts generally considered as active or productive oil fields. A deputy will absent himself from his regular place of duty, except during holidays and Sundays, only after communication with the supervisor. It is absolutely necessary that

the whereabouts of all deputies be at all times known to the supervisor, for the reason that immediate communication is frequently necessary.

Petroleum engineers, inspectors and office assistants report directly to and receive orders directly from the deputy in charge of the district to which they are assigned. All communications from an officer subordinate to a deputy and dealing with the work of the department must be addressed to the deputy.

Vacations are provided for under regulations issued by the Civil Service Commission and the Board of Control.

Request for leave of absence must be transmitted by the deputy of the district, with his recommendations, to the supervisor.

All expenditures must be made in accordance with regulations issued by the secretary of the State Mining Bureau. All requisitions, expense accounts and vouchers must be approved by the deputy in charge of the district and forwarded by him to the secretary.

Circular letters on specific subjects, insuring uniformity of practice in minor details of our work, are issued from time to time to the various deputies. Each deputy is expected to be familiar with the circulars and also to see that they are brought to the attention of all members of his staff.

GENERAL REQUIREMENTS GOVERNING MEMBERS OF THE DEPARTMENT OF PETROLEUM AND GAS.

In view of the number of subordinate officers in the employ of this department, it has become desirable to acquaint them with our general policy relative to retention or advancement in the service.

The department is primarily required to furnish technical assistance to oil operators, or, in other words, we are largely concerned in solving problems requiring technical training. Most of the conditions leading to the passage of the law under which we operate were not brought about by lack of mechanical skill on the part of workmen at the wells. The damaged condition of the oil deposits is due primarily to the fact that most operators have failed to study underground conditions and carefully plan their development work to meet such conditions.

Therefore, in choosing new employees, more stress is laid on mental training and alertness than on mechanical experience and dexterity. Education and experience have been considered, but it must be emphasized that neither of these qualifications will, by themselves, bring advancement. We specially need men who are mentally vigorous and interested in thorough and correct solutions of the problems coming before us. *In fact, the solution of the problems must actually and naturally be a pleasure to a man if he is to succeed in the work.* This is a condition prevailing in all branches of engineering work.

We shall frequently be unable to specifically point out to other members of the staff more than the general method to be pursued in solving a problem. With even greater frequency we shall be unable to supply them with all the facts necessary for a correct solution. In order to succeed in the work, a man will therefore have to rely principally upon his own resourcefulness, always remembering that we must finally have a definite and concise answer to the problem. This will not conflict with the fact that some of the problems can not be solved with any of the data obtainable, but in such case we shall expect a clear demonstration proving the impossibility of solution.

It may be necessary for some men, who have had considerable so-called "practical" experience in the oil fields, to actually unlearn or forget some theories which may have appeared to them as facts. In reality there are too few known facts relative to the conditions with which we have to deal. A statement that a proposition should be considered in a certain way, merely because it has been so considered in the past, has little or no force in this department.

The foregoing statements must not be interpreted as a statement that we are without any definite methods of procedure. On the contrary, the past two years have enabled us to outline certain plans and establish some definite forms necessary to the carrying on of our work. New members of our staff will be expected to become thoroughly familiar with such methods as we have perfected, and the deputies will arrange work so as to facilitate such schooling.

It is specially important that all members of the staff shall be able to briefly and correctly write reports so that other persons, upon reading the reports, will be entirely informed, and not require further explanations. It must be remembered that our correspondence and reports may at any time come before contending parties, intent upon twisting words into various meanings. This apparently simple accomplishment of writing reports is, in fact, one of the most difficult and will require constant study and practice.

Accuracy of observation and statement are absolutely essential. It is inexcusable to state that a measurement is "about" so much, if it is practicable to give the exact figures. On the other hand, it frequently happens that an approximate figure is sufficient, but the same care in wording must be used so that the reader will recognize the fact that the writer had merely approximated.

It is assumed that all members of our staff have the elementary virtues, such as honesty, punctuality and industry.

This letter, issued to members of the department, may appear too long, but, as a matter of fact, it merely hints at subjects requiring close application and constant study. It should be impressed upon

all subordinate officers that we need and expect their utmost endeavor and co-operation, and that in turn we aim to assist them in improving their own opportunities for advancement. Such opportunities exist within the department, but advancement will come only to those who "deliver the goods."

EFFICIENCY RECORDS OF MEMBERS OF THE DEPARTMENT.

The policy of basing promotion of subordinate officers upon efficiency requires the installation of a system for recording their performance. A record is made each week on a form listing the decisions rendered by a deputy supervisor. Columns are provided on the form for each engineer or inspector in the district.

A rating number is given by the deputy to each report (either form 109 or 111). The rating is placed in the column of the officer who has furnished the data upon which the report is based.

Rating is based on two features: First, accuracy and completeness in observing and recording facts; second, correctness of conclusions drawn from observed facts. Rating is applied to the written data furnished to the deputy by the inspector or engineer. The rating is made by the deputy at the time he receives the data and prior to the writing of the final report signed by the deputy.

There are three grades, as follows:

First Grade (recorded by figure "1") is given for data correct and complete both as to facts and conclusions.

Second Grade (recorded by figure "2") is given for data which are correct and complete as to facts, but which need revision as to the written conclusions.

Third Grade (recorded by figure "3") is given for data incorrect as to facts.

Lists showing the average rating of all subordinate officers in the department will be distributed by the supervisor to all deputies from time to time.

The figures obtained by this rating will be an important guide in determining efficiency, but will not be the sole source of information.

The proper handling of reports upon *proposed operations* will indicate greater ability than will an equal rating based entirely upon reports of *tests*.

Supplementary information as to personality (ability to deal with the public), initiative, promptness, and similar important points, will, from time to time, be compiled by the supervisor and deputies, in conference.

WEEKLY WORK REPORTS BY ENGINEERS AND INSPECTORS OF THE DEPARTMENT.

Each engineer or inspector in the department fills out a weekly report showing disposition of his time.

INDIVIDUAL WORK REPORT.

Week ending---------- 191___

(Signed)----------

(Inspector-Engineer)

	Field work					Office work		
	Tests			Special investigations, surveys, etc., hours	Auto miles	Reports on field work, hours	Recommendations, special reports, hours	Drafting or models, hours
	Routine, number	Special, number	Hours					
Sunday								
Monday								
Tuesday								
Wednesday								
Thursday								
Friday								
Saturday								

Suggestions: ----------

This report is to be filled in by the engineer or inspector each evening with approximate figures. The deputy will send this report to the supervisor and retain a copy. The purpose of the report is to determine the best disposal of available time and men. It is not for the purpose of speeding the men, as accuracy is of prime importance.

The headings of the various columns are more completely defined as follows:

1. Routine tests are those involving the bailing down of a well, measurement of casing, bottom fluid level, etc.

2. Special tests are those involving the witnessing of such operations as mudding, cementing or testing of plug to see whether it has set.

The total number of each sort of test made in a day is to be recorded in the appropriate column. The total number of hours involved in such field work should be recorded in the appropriate column.

3. Special investigations, surveys, etc., include such work as the visiting of wells or properties for the purpose of gathering information not covered by tests. The total number of hours per day consumed by such work should be covered.

4. The total number of miles travelled by automobile, on field work alone, should be recorded each evening.

Under the heading of office work, the columns are as follows:

5. Reports on field work include the writing up of such field notes and conclusions as may follow tests.

6. Recommendations and special reports cover the time involved in searching through our records and the writing of a tentative report upon proposed operations or an engineering investigation of a property.

7. Drafting or models is self-explanatory, and includes the work or maps or making of models.

8. Suggestions. These three lines are intended to give the inspector or engineer an opportunity to suggest anything he may deem advisable looking to the improvement of the work coming under his observation. Suggestions should be made with considerable care, as they will clearly indicate the writer's grasp of the subject upon which he makes suggestions.

METHOD OF TESTING WATER SHUT OFF AT OIL WELLS.

Time and expense will be saved to well owners if the following steps are taken in preparing a well for inspection by the State Mining Bureau:

1. Measurements to the bottom of the hole and to the bottom of the casing shoe must both be carefully checked before the casing is landed or cemented and before notifying the deputy supervisor of intention to test. A steel tape should be used in determining the distance that the sand line or drilling line "measures over."

2. Casing must be tested by bailing the well to a safe depth (see collapsing strength of casing, page 46) before drilling below the shoe. Old casing may collapse with less pressure than that indicated for new casing. Testing by applying pump pressure inside the casing will not always reveal leaks.

3. Drilling out of cement or other material in the casing must be carefully done to avoid damage to the shut-off. The drill must merely be run far enough to go entirely through the cement and below the shoe. A distance of from five to ten feet below the shoe should be ample. By drilling too far below the shoe complications may arise which will prevent a positive test.

4. Bailing should, if possible, continue until all fluid is removed from the hole, unless there is danger of collapsing the casing. It is advisable to run the bailer until it brings up nothing but mud on the last run, then allow the well to stand an hour or more and again bail to remove water which has sprayed onto the inside of the casing and drained down. When a well is in such condition that it can not be safely bailed dry,

the fluid should be lowered to a certain depth by continuously running the bailer to that depth until no more fluid is brought up. A permanent target should be placed on the line to mark the bailing point. If both oil and water are present in a well which can not be bailed dry, it may be necessary to remove the water by continuously bailing it from the bottom of the well until the bailer fails to bring up water. The well should be allowed to stand several hours and the bailer run to increasing depths to determine the point where it again picks up water. At this point the well is ready for inspection by the deputy supervisor and afterwards the water may again be removed by bailing from the bottom of the well, account being kept of the amount bailed out. It may be necessary to repeat this process several times in order to determine whether the water is being exhausted. In case of high pressure and flow of gas, or in case of heaving formation, it will probably be possible to only test the well by pumping.

5. When a tight or closed bailer is used in a deep well, some sort of outlet or valve should be provided in order to relieve the pressure, which may endanger the lives of persons in the derrick when the bailer comes out of the well.

A leaky bailer should not be used in testing.

6. A well must stand *at least twelve hours without any bailing whatever* before it is to be witnessed by a representative of the bureau, and a longer time is preferable.

7. The law requires that the bureau be given written notice at least five days before a test. It will save time for both the operators and the state officials if additional notice of the exact time be given by telephone.

A proper test to determine whether or not a sand carries oil or water can not be made unless water from all other possible sources is absolutely excluded. This fact is well known to all careful operators, but the officers of this department have frequently heard contrary arguments advanced and it may be of interest to give the details of a single case, illustrating a common occurrence.

At well No. 80 of the Petroleum Development Company, Sec. 8, T. 3 S., R. 9 W., S. B. B. & M., in the Olinda field, a "dry sand" was reported in the log between depths of 1015 ft. and 1029 ft. While drilling the hole was carried full of water. When the bottom of the hole was at the last mentioned depth a string of casing was landed at a depth of 988 ft. After the casing was landed bailing commenced, and upon lowering the water to a depth of 200 ft. oil began to show. All the fluid was bailed from the well and after standing 29 hours the hole filled with oil up to a depth of 128 ft. from the surface.

If such a bailing test had not been made a productive sand would have been passed through without its value being recognized.

There is no doubt that in the past many productive sands have been so passed. The requirements of this department now prevent such losses.

When gas is flowing, in large quantities and under great pressure, from a well it is sometimes difficult to determine whether or not water has been properly shut off. It has frequently been assumed that a constant flow of dry gas showed that the water had been shut off. There is, however, a possibility that the gas pressure may be great enough to hold back water which would otherwise enter the well. That such is actually the case is shown by the following occurrence.

At well No. 12 of the Honolulu Consolidated Company, Sec. 10, T. 32 S., R. 24 E., M. D. B. & M., in the Midway field, a test of water shut-off was made by merely observing the dry gas blowing from a two-inch opening. The test was not considered conclusive by this department and the well was passed for further observation after the well should be producing. About a week later the well for some reason got out of control and gas flowed at a rate estimated at from five to seven million cubic feet per day. Accompanying the gas was water amounting to about 700 bbls. per day. Within a day or two the well was again capped and the flow of water was reported as decreasing. The well can of course be properly repaired, and the occurrence is here reported merely to show that dry gas may come from a well which may also contain water.

RULES FOR MEASURING DEPTH OF WELLS AND CASING.

Methods of measuring the depth of oil wells, and the amount of casing put into them, are of extreme importance in order that water shall be shut off at the proper depth and casing perforated between the proper depths. While the matter may appear of slight importance to some careful operators, it has been found that gross errors are frequent enough to justify some general regulations.

In order that the advice and suggestions of skilled oil-well workers might be had before rules were adopted by the State Mining Bureau, letters were written to all authorized agents appointed by the oil producers of California. About fifty replies were received and the comments carefully studied. These replies, together with the experience of officials of this department, serve as the basis for the following regulations, which will hereafter be applied to work passed on by the State Oil and Gas Supervisor.

1. All measurements must be made with a steel tape. Cloth or metallic tapes can not be depended upon, as they are subject to great change in length. A five-foot stick used on a sand or drilling line, for distances

more than two hundred feet, is inaccurate. The reasons for such inaccuracy are that exact markings on the line at the ends of the stick are difficult to make and their great number quickly multiplies the error.

2. The depth of well shall *in all cases* be determined by running a bailer or string of tools to the bottom. The unit of measurement, when cable tools are used, shall be the distance from the floor of the derrick along the sand line over to a point level with the top of the flanges of the reel. This is commonly known as the distance the derrick "measures over," and details for such measurement are stated below. If measurement is on the drilling line, it shall be from the floor over to a point near the bull wheel and five feet above the floor, as determined by setting up a five-foot stick.

The depth of a rotary hole, before casing is put in, shall be determined by measuring each stand of drill pipe with steel tape, measurement to be from top of tool box joint to bottom of shoulder on tool joint pin.

3. The length of a string of casing shall, *when considered necessary by the supervisor or deputy,* be determined by measuring to the shoe of the casing from the derrick floor. This measurement can be made on the drilling line by using an under-reamer, a latch-jack, or any other tool which definitely locates the shoe of the casing.

4. A derrick should be "measured over" immediately before it is intended to measure the depth of well or of casing. A measurement made when the rig is new may not be correct after the rig and rig irons have been in use for some time.

The "distance over" can be determined in the following manner, using a bailer and sand line:

(*a*) Run the bailer into the well a short distance and tie string on the sand line level with the surface of the floor, using a straight edge or steel square to determine the correct position.

(*b*) Tie a strand of rope (target) tightly on the sand line at a position on a level with the top of sand reel flanges, laying a straight stick on top of the flanges to determine this position.

(*c*) Lower the bailer into the well until the target is within easy reach from the derrick floor. Attach the end of a steel tape to the sand line at the target. Raise the bailer until another target can be fastened at the end of the tape and tie another target. Lower the bailer, detach tape, hoist bailer and attach tape at the second target, hoist bailer and set a third target. Repeat the operation until it is possible to measure with the tape to the target first set at the floor. The tape must be shorter than the height of the derrick, so that it will not go over the pulley at the crown block.

When a target is tied to the line, paint should be put on the line above and below the target, to show any displacement of the target.

To measure into the well, after the unit length or "distance over" is determined, hold the bottom of the bailer dart, when raised, level with the surface of the floor, set a target at the top of the flanges of the reel, lower the bailer until the target is level with the floor, and set a second target at the reel. Correct count of the targets is most easily kept by detaching and keeping each one as it reaches the floor.

The depth can also be conveniently measured when the bailer is pulled out of the well by setting the first target even with the floor, while the bailer is on bottom, hoisting until the target reaches the flanges of the reel, set new targets at floor level and remove old ones as they reach the reel.

GENERAL REQUIREMENTS FOR ABANDONING OIL AND GAS WELLS.

In the abandonment of wells drilled in the vicinity of petroleum and gas deposits, the State Oil and Gas Supervisor will require sufficient work to protect the deposits from damages by infiltrating water and other causes. Conditions vary from well to well, so that definite rules seem impossible, and final determination of the requirements for each individual case will be made by the deputy supervisor in charge of the district where a well may be located. However, the requirements will conform as far as possible to the general policy herein set forth.

1. The law requires that the State Oil and Gas Supervisor be given written notice of intention to abandon a well five days before work is to begin. The notice should state the reason for abandonment, and must also state in detail the proposed method of abandonment. Blank forms for this purpose may be obtained at any office of the department. A log of the well, written in duplicate on forms furnished by the supervisor together with a complete statement of the present condition of the well, must be filed before approval of the proposal will be granted.

In case of an emergency, where the operator desires to act immediately, he should telephone the deputy supervisor, who will expedite matters as much as possible in compliance with the law.

2. When the depth or location of a well show to the satisfaction of the deputy supervisor that no oil or gas bearing formations have been penetrated, approval may be given to a proposal contemplating the removal of all casing without the placing of any plugs. This will only cover very exceptional cases.

3. In most cases sufficient casing should be left in a well to serve as a conductor from the ground surface to the point of shut-off. The desirability of such a requirement is based on the fact that it is frequently impossible to immediately and directly prove the effectiveness of plugging. It may be necessary to note the behavior of neighboring wells for a considerable period of time before it is known that plugging

is effective. In some cases the condition of surrounding wells may demonstrate that plugging was not effective and that further work is necessary at the abandoned well. The well could not be economically entered if all casing had been removed. Furthermore, it is believed that in most wells it does not pay to attempt to pull casing below the shoe of the next larger casing, as ordinarily only one or two joints of casing in contact with the walls of the hole can be recovered.

4. It is generally required that cement plugs be put in between various zones of oil or gas producing formations, in order to prevent the possible passage of water from one stratum to another in the future. In most wells it will be necessary to remove or shoot casing between depths at which plugging should be done, so that cement may reach the walls of the well. Wells which have sidetracked casing would require a larger shot than those which have not such casing. The casing in a well, between the shoe of the water string and a point at least fifteen feet below, should be pulled out or broken up by shooting, and the well should be plugged with cement in the formation between these depths and up into the water string for at least twenty feet.

5. In case of effective water shut-off, wells, which do not have suitable formation in which to plug below the shoe of the water string, should be plugged inside of such string for at least twenty feet directly above the shoe.

6. Each cement plug put into a well must be allowed to set at least 24 hours (a longer time is advisable), after which determination must be made that the cement properly sets before further plugging is done.

7. When a well is making "bottom" water, the level at which fluid (water and oil) stands in the well should be accurately determined both before and after plugging in the bottom. If possible the well must be plugged in a formation which may separate water bearing from overlying oil or gas formations. The well must be tested by bailing to determine the effectiveness of the plugging, and such test must be witnessed by a representative of the state supervisor. After approval of such test has been given, the well should be plugged further along the lines indicated in paragraphs 4 and 5.

8. When a well is making "top" water around the shoe of the water string, it will be necessary, in addition to the plugging between formations, as required in paragraphs 4 and 5, to place a cement plug in suitable formation directly below the water string. If suitable formation for plug is present, the water string should be shot or removed above the shoe at a point opposite impervious formation, and a cement plug should be placed in bond with the formation where casing was shot or removed.

9. When a well is making "top" water through the water string, it should be plugged as provided in paragraphs 4 and 5.

10. When a well penetrates "intermediate" water below the water string, it should be plugged in formation which may separate water bearing formations from the overlying and underlying oil or gas bearing formations. The depths to the fluid level should be measured and the well tested to determine the effectiveness of the plugging, as indicated in paragraph 7.

11. When a well penetrates "intermediate" water above the shoe of the water string, and mud laden fluid or cement have been effectively used for the protection of oil or gas bearing formations, back of the casing, the water string should not be disturbed unless it is proposed to put in cement plugs between oil and gas bearing formations. Where the original protection by mud or cement was ineffective, it will be necessary to shoot or rip the water string at places where plugs will be required to separate and protect oil or gas bearing formations. To test the effectiveness of the original protection, the water string should be perforated or ripped opposite the oil or gas bearing formations. If the test demonstrates proper protection, the casing should be plugged to points at least ten feet above and below the perforation or ripping, to seal the openings in the casing. A water string which protects with the aid of cement and mud, oil or gas bearing formations behind the casing, may be cut off (not shot) about twenty feet above the shoe at the next larger casing. A cement plug must then be placed at the top of the casing.

12. When the source of water can not be definitely determined, it will be necessary to combine all the requirements for various known sources.

13. Attention is called to the fact that in some cases shooting is inadvisable, as it may break up formations depended upon to prevent the passage of water. In many such cases the casing may be cut into five-foot lengths, thoroughly ripped, and pounded down with the tools.

14. It seems probable that *mud laden fluid,* when properly introduced into a well, will serve to effectually and economically close all openings through which fluid might pass. More than ordinary care is necessary in the use of this method, which has been fully described in Bulletin No. 134 of the U. S. Bureau of Mines, Washington, D. C. The subject is also covered in the first annual report of the state supervisor (pages 217 to 222), and on pages 43 to 45 of this report. Operators are urged to carefully consider the advantages of this method.

15. Approval of completed abandonment work will be given by the supervisor only upon a satisfactory showing that it has been done according to specifications issued by this department at the time of

the proposal. The operator is advised to keep the deputy supervisor informed as to the progress of the work, so that inspection can be made whenever deemed necessary. Such procedure will serve to insure the operator against future complaints and also save him expense. It will also be necessary for the operator to file with the deputy supervisor a sworn statement, written in duplicate, giving all details of the completed work. The statement must give the following information:

(*a*) Names of all workmen employed on the job.

(*b*) Dates when work was commenced and completed, and additional dates of particularly important features of the work.

(*c*) Depth to which hole was cleaned out.

(*d*) Depths at which casing was cut, ripped or shot, together with kind and amount of explosive used in the various shots.

(*e*) Amounts and sizes of all casing removed from the well.

(*f*) Depths at which plugs were placed, together with statement of kinds and amounts of materials composing each plug, together with statement of tests made to prove effectiveness of all plugs.

Properly kept tour reports or diary will furnish the required information without inconvenience to the operator.

PEG MODELS.

Rods or pegs set in proper relative positions both horizontally and vertically and colored to represent formations encountered in a bore hole have for many years been used in connection with mining operations. Such models give a mental impression which is not so readily obtained from cross-sections or contour maps. This department is engaged in constructing such models as fast as the size of our staff permits and hopes to eventually cover all areas where geological conditions are complex.

Considerable effort has been given to devising uniform specifications which will meet the necessities of economy in time, labor and material, and at the same time show the maximum amount of information. The future should see many similar models constructed by oil operators and our specifications are therefore published in the hope of offering some suggestions.

Our models are made entirely of wood on a scale of 100 ft. to the inch.

Each model covers one quarter section of land. Skeleton tables support four of the quarter section models.

The baseboard is of clear pine surfaced to a thickness of $1\frac{1}{4}$ inches. A blue print map showing wells, property lines and names is pasted on the baseboard and holes bored to receive a peg at each well location. The pegs are $\frac{1}{2}$ inch in diameter. A blue-printed graphic log,

showing the casing in detail and also the geological formations, (see cut, page 21) is pasted on the peg. The pegs fit in the baseboard.

Strings are fastened from peg to peg, correlating the important formations. Red strings denote oil bearing formations. Yellow strings denote water bearing formations.

Pins with colored spherical heads about $\frac{1}{8}$ inch in diameter are also stuck in the pegs to call attention to specially important features, such as point of shut-off or bottom of open hole.

Productiveness, both oil and water, can be conveniently brought to attention by small colored tabs or flags in the top of the pegs.

AMENDED LAW.

Administration of the law as first enacted developed minor deficiencies, as was expected by the framers. Prior to the legislative session of 1917 the State Mining Bureau prepared amendments and mailed copies to all oil operators. The proposals covered two main features, namely, administrative details and method of levying assessment.

The principal change from the original law, in addition to those suggested by this department, is the formation of boards of commissioners to perform the duties previously left to special boards of arbitration.

The advisability of depending upon elective boards to decide disputed technical matters remains to be determined and was so accepted by the officers of the State Mining Bureau.

5—30639

CHAPTER 718.

An act establishing and creating a department of the state mining bureau for the protection of the natural resources of petroleum and gas from waste and destruction through improper operations in production; providing for the appointment of a state oil and gas supervisor; prescribing his duties and powers; fixing his compensation; providing for the appointment of deputies and employees; providing for their duties and compensation; providing for the inspection of petroleum and gas wells; requiring all persons operating petroleum and gas wells to make certain reports; providing procedure for arbitration of departmental rulings; creating a fund for the purposes of the act; providing for assessment of charges to be paid by operators and providing for the collection thereof; and making an appropriation for the purposes of this act.

[Approved June 10, 1915. Amended 1917. Chapter 759.]

The people of the state of California do enact as follows:

Establishment of department. Appointment of supervisor.

SECTION 1. A separate department of the state mining bureau is hereby established and created to be known as the department of petroleum and gas. Such department shall be under the general jurisdiction of the state mineralogist. He shall appoint a supervisor who shall be a competent engineer or geologist experienced in the development and production of petroleum and who shall be designated the "state oil and gas supervisor," and whose term of office shall be four years from and after the date of his appointment.

Appointment of assistants. Compensation.

SEC. 2. For his services in the general supervision of said department, the state mineralogist shall receive as compensation one thousand four hundred dollars annually which shall be in addition to his compensation fixed in section two of the act of June 16, 1913, relating to the state mining bureau. The secretary of the state mining bureau shall receive for his services in connection with the department of petroleum and gas, a sum not to exceed six hundred dollars annually, which sum shall be in addition to his compensation paid from the funds of the state mining bureau.

The supervisor shall receive an annual salary of six thousand dollars, and shall be allowed his necessary traveling expenses. The state mineralogist may, at the request of the state oil and gas supervisor, and subject to the civil service laws of the state, appoint one chief clerk at a salary of not to exceed one thousand eight hundred dollars annually; twelve office assistants or stenographers each at a salary not to exceed one thousand two hundred dollars annually; four geological draughtsmen each at a salary not to exceed one thousand five hundred dollars annually; four petroleum engineers each at a salary not to exceed two thousand four hundred dollars annually; twelve inspectors each at a salary not to exceed one thousand eight hundred dollars annually.

The additional salary herein authorized to be paid to the state mineralogist and the secretary of the state mining bureau and the salaries of the supervisor and of the deputies, clerks, stenographers, assistants and other employees shall be paid out of the funds hereinafter provided for at the times and in the manner that salaries of other state officers and employees are paid.

Duties of supervisor.

SEC. 3. It shall be the duty of the state oil and gas supervisor so to supervise the drilling, operation and maintenance and abandonment of petroleum or gas wells in the State of California, as to prevent, as far as possible, damage to undergraund petroleum and gas deposits from infiltrating water and other causes and loss of petroleum and natural gas.

Appointment of deputies and attorney.

SEC. 4. It shall be the duty of the state oil and gas supervisor to appoint one chief deputy and five field deputies, one for each of the districts hereinafter provided for and prescribe their duties and fix their compensation, which shall not exceed four thousand dollars per annum for the chief deputy and not to exceed three thousand

six hundred dollars per annum for each field deputy. Such deputies shall serve during the pleasure of the supervisor. He shall also employ an attorney at a compensation not exceeding three thousand dollars per year, payable out of said fund, who shall also be attorney for each district board of commissioners; such commissioners may allow additional compensation to such attorney in actual litigation. The supervisor, the deputies and the attorney shall not be subject to the civil service act.

Duties of deputies.

SEC. 5. Each deputy appointed by the supervisor shall be a competent engineer or geologist, experienced in the development and production of petroleum. At the time said deputy is appointed, notice of such appointment shall be transmitted in writing to the board of commissioners of the district for which said deputy is appointed. Said notice shall be given either personally or by mailing a notice of said appointment to the post-office address of each commissioner. No appointment shall be final until a period of ten days shall have elapsed from the mailing of said notice to said commissioners. In the event the majority of the commissioners notify said oil and gas supervisor in writing before the expiration of ten days from the date of said notice that the appointment of said field deputy is disapproved by them, then and in that event said field deputy shall not be appointed but said oil and gas supervisor must appoint some other individual as in this section provided. Each field deputy shall maintain an office in the district for which he is appointed, convenient of access to the petroleum and gas operators therein. The office shall be open and the deputy shall be present at certain specified times which shall be posted at such office.

SEC. 6. It shall be the duty of each deputy, to collect all necessary information regarding the oil wells in the district, with a view to determining the presence and source of water in the oil sand, and to make all maps and other accessories necessary to determine the presence and source of water in the oil sands. This work shall be done with the view to advising the operators as to the best means of protecting the oil and gas sands, and with a view to aiding the supervisor in ordering tests or repair work at wells. All such data shall be kept on file in the office of the deputy oil and gas supervisor of the respective district.

Records and their use.

SEC. 7. The records of any and all operators, when filed with the deputy supervisor as hereinafter provided, shall be open to inspection to those authorized in writing by such operators, to the state officers, and to the board of commissioners hereinafter provided for. Such records shall in no case other than those hereinafter and in this section provided, be available as evidence in court proceedings and no officer or employee or member of any board of commissioners shall be allowed to give testimony as to the contents of said records, except at such court proceedings as are hereinafter provided for in the review of the decision of the state oil and gas supervisor, or a board of commissioners, or in any proceedings initiated for the enforcement of an order of the supervisor, or any proceeding initiated for the enforcement of a lien created by this act, or any proceeding for the collection of the assessment levied under and pursuant to the provisions of this act or in criminal proceedings arising out of such records, or the statements upon which they are based.

Orders by supervisor. Agents of operators.

SEC. 8. It shall be the duty of the supervisor to order such tests or remedial work as in his judgment are necessary to protect the petroleum and gas deposits from damage by underground water, to the best interests of the neighboring property owners, and the public at large.

The order shall be in written form, signed by the supervisor, and shall be served upon the owner of the well, or the local agent appointed by such owner, either personally or by mailing a copy of said order to the post-office address given at the time the local agent is designated, or if no such local agent has been designated, by mailing a copy of said order to the last known post-office address of said owner,

or if the owner be unknown by posting a copy of said order in a conspicuous place upon the property, and publishing the same in some newspaper of general circulation throughout the county in which said well is located, once a week for two successive weeks.

Said order shall specify the condition sought to be remedied and the work necessary to protect such deposits from damage from underground waters. For this purpose each operator or owner shall designate an agent, giving his post-office address, who resides within the county where the well or wells are located, upon whom all orders and notices provided for in this act may be served.

Rejection of supervisor's orders, and appeal.

SEC. 9. The well owner or his local agent may within ten days from the date of service of any order from the supervisor, file with the supervisor or his deputy in the district where the property is located, a statement that the supervisor's order is not acceptable and that appeal from said order is taken to the board of commissioners. Such appeal shall operate as a stay of any order issued under or pursuant to the provisions of this act.

Districts, commissioners, election, recall.

SEC. 10. For the purposes of this act the state shall be divided into five districts, as follows:

District No. 1, including the counties of Los Angeles, Riverside, Orange, San Diego, Imperial and San Bernardino.

District No. 2, the county of Ventura.

District No. 3, including the counties of Santa Barbara, San Luis Obispo, Monterey, Santa Cruz, San Benito, Santa Clara, Contra Costa, San Mateo, Alameda and San Francisco.

District No. 4, including the counties of Tulare, Inyo and Kern.

District No. 5, including the counties of Fresno, Madera, Kings, Mono, Mariposa, Merced and all other counties in California not included in any of said other districts.

There shall be elected at the times and in the manner hereinafter provided, district oil and gas commissioners for each such district, as follows:

For district number one, five; for district number two, five; for district number three, five; for district number four, seven; for district number five, five.

Said district oil and gas commissioners shall be elected by vote of the companies, individuals, copartnerships or associations, who shall have been assessed, and whose names shall appear on the last record of assessments (next preceding such election) for and on account of the fund in this act provided to be raised, within said districts respectively, said vote to be taken at a meeting to be held in each of said districts respectively, and on the third Monday in September of each year, such place and the time and details of such meeting to be fixed by the state oil and gas supervisor, and of which meeting at least two weeks previous notice shall have been given by letter addressed to each of said persons, corporations, copartnerships and associations, entitled to vote as aforesaid, at his or its post-office address or principal place of business.

At said meeting each of those entitled to vote as herein provided may be represented by one person holding the written authority of such voter to act for him at such meeting.

At said meeting each voter shall be entitled to one vote for each member of the board of district oil and gas commissioners who are required to be selected for such district. In addition thereto, in each district in which five commissioners are to be elected, each voter shall be entitled, for each one hundred dollars, or fraction thereof, which said voter shall have paid in accordance with his last assessment hereunder, to cast one vote for the two commissioners who are elected for three years; and in each district in which seven commissioners are to be elected, each voter shall be entitled, for each one hundred dollars, or fraction thereof, which said voter shall have paid in accordance with his last assessment hereunder, to cast one vote for the three commissioners who are elected for three years. In all subsequent elections the qualification of voters in the election of a commissioner shall be the same as in the election of the commissioner whose successor in office is being elected.

Said meeting shall select by ballot, by a majority vote of the votes represented, the number of persons as hereinbefore specified to act as district oil and gas commissioners for such district.

In any district entitled to seven commissioners, two shall be chosen for a term of one year, two for two years and three for three years. In any district entitled to five commissioners, one shall be chosen for a term of one year, two for two years and two for three years.

The chairman and secretary of the meeting shall issue a written certificate to the state oil and gas supervisor, setting forth the result of such election, and the name and address of each of the persons elected at said meeting as the district oil and gas commissioners for said district and the term for which each has been elected. No person shall be eligible as a district oil and gas commissioner who is not a resident of the district for which he is elected, nor shall any person be eligible for such position who is not actually engaged in the business of oil or gas development or production, within the district.

Upon receipt of the certficate so made by the chairman and secretary of any such meeting, the state oil and gas supervisor shall issue a certificate of election to the respective persons in said certificate named as the district oil and gas commissioners for said district, and for the periods of one, two or three years from and after the first Monday in October, 1917, as shall be shown in such certificate, and until their respective successors shall have been elected.

Within thirty days after their appointment by the state oil and gas supervisor, the district oil and gas commissioners for each district shall meet at a time and place within the district to be designated by the state oil and gas supervisor, and shall thereupon select one of the number as chairman.

The deputy supervisor of the district shall be ex officio secretary of said board, and shall keep a record of its proceedings, and his office shall be the office of the commissioners.

Said commissioners shall serve without compensation, except their necessary traveling expenses. The traveling expenses of said commissioners and all actual expenses incurred by or under order of said commissioners in the hearing and determination and carrying out of orders appealed to them, shall be certified to said state supervisor, and when audited by him and by the state board of control shall be paid from said fund.

On the third Tuesday in September of each year at an hour and places in said respective districts to be fixed by the state oil and gas supervisor, and of which notices shall have been given as hereinbefore specified, the successor of each of the district oil and gas commissioners whose term of appointment shall expire that year, shall be elected and qualified in the manner and subject to the provisions hereinbefore set forth, and the term of each shall be for a period of three years from and after the first Monday in October next succeeding.

All, either or any of the district oil and gas commissioners elected in any district may be recalled by the votes of a majority of the qualified votes of the district entitled to vote as to such commissioners respectively. In case there shall be filed in the office of the state oil and gas supervisor, a written petition, signed by not less than forty per cent of those entitled to vote as to the election of any commissioner or commissioners, asking the recall of such commissioner or commissioners, said state oil and gas supervisor shall, within ten days thereafter, order and give notice of, a special election in such district to fill the office or offices of the commissioner or commissioners named in said petition for recall; and shall cause notice to be given of said election in the manner, and for the time required for regular election, and said notice shall fix the time and place of such election.

At such election, the commissioner or commissioners named in such petition for recall shall be voted upon as though candidates for election for the unexpired portion of the term for which they, respectively, were originally elected, and any other candidate or candidates may, at the same time, be voted upon. It shall require a majority of all the qualified votes entitled to vote for such commissioners, respectively, to constitute an election. In case less than a majority of all qualified votes

shall be cast for any candidate, said recall shall be deemed to have failed as to the commissioner concerning whose office such vote was taken; and in case such commissioner himself shall receive a majority of the votes, said recall shall be deemed to have failed, and in either of such cases, such commissioner shall continue to serve until the expiration of his term as though no such special election had been held. But in case any person other than such commissioner shall receive a majority of the votes for such unexpired term, then such recall shall become effective and the office of the commissioner so recalled shall be vacant and upon written certificate of such election being filed with the state oil and gas supervisor, the person so chosen and elected for such unexpired term shall become the successor of the commissioner so recalled, and a certificate of his election for such unexpired term shall be issued and transmitted to him by the state oil and gas supervisor. And like proceedings shall be had in case more than one commissioner shall be included in said petition for recall.

In all recall elections, qualifications for voters and the numbers of votes which they will be entitled to cast shall be the same as they respectively were in the election of the commissioner as to whom such recall election is being held.

In case of vacancy caused by the death, resignation or removal from district or ceasing to be engaged in the business of development or production of oil or gas in the district as to the office of any commissioner, such vacancy shall be filled until the next annual election by the state oil and gas supervisor, who shall appoint to fill such vacancy an eligible person, nominated in writing by the remaining commissioners of such district.

Upon any subject in which any commissioner is personally interested, or upon which any corporation, copartnership, association or individual by whom he is employed is directly interested as a party, such commissioner shall not be entitled to sit or vote.

The board of commissioners shall be entitled to call upon the supervisor for advice, and written report upon any matter referred to the board of commissioners, and the supervisor shall be entitled to call meetings of the commissioners at the office of the field supervisor, upon five days' written notice, to obtain their written advice upon any matters relating to his work within their district.

Complaint, investigation and order.

SEC. 11. Upon receipt by the supervisor or deputy supervisor of a written complaint specifically setting forth the condition complained against, signed by a person, firm, corporation or association owning land or operating wells within a radius of one mile of any well or group of wells complained against, or upon the written complaint specifically setting forth the condition complained against, signed by any one of the board of commissioners for the district in which said well or group of wells complained against is situated, the supervisor must make an investigation of said well or wells and render a written report stating the work required to repair the damage complained of, or stating that no work is required. A copy of said order must be delivered to the complainant, or if more than one, each of said complainants, and if the supervisor order the damage repaired, a copy of such order shall be delivered to each of the owners, operators or agents having in charge the well or wells upon which the work is to be done. Said order shall contain a statement of the conditions sought to be remedied or repaired and a statement of the work required by the supervisor to repair such condition. Service of such copies shall be made by mailing to such persons at the post-office address given.

Testimony.

SEC. 12. In any proceeding before the board of commissioners as herein provided, or in any other proceeding or proceedings instituted by the supervisor for the purpose of enforcing or carrying out the provisions of this act, or for the purpose of holding an investigation to ascertain the condition of any well or wells complained of, or which in the opinion of the supervisor may reasonably be presumed to be improperly drilled, operated, maintained or conducted, the supervisor and the chairman of the board of commissioners shall have the power to administer oaths and may apply to

a judge of the superior court of the State of California, in and for the county in which said proceeding or investigation is pending, for a subpœna for witnesses to attend at said proceeding or investigation. Upon said application of said supervisor or said chairman of said board of commissioners, said judge of said superior court must issue a subpœna directing said witness to attend said proceeding or investigation; *provided, however,* that no person shall be required to attend upon such proceeding, either with or without such books, papers, documents or accounts unless residing within the same county or within thirty miles of the place of attendance. But the supervisor or the chairman of the board of commissioners may in such case cause the depositions of witnesses residing within or without the state to be taken in the manner prescribed by law for like depositions in civil actions in superior courts of this state, and to that end may, upon application to a judge of the superior court of the county within which said proceeding or investigation is pending, obtain a subpœna compelling the attendance of witnesses and the production of books, papers and documents at such places as he may designate within the limits hereinbefore prescribed. Witnesses shall be entitled to receive the fees and mileage fixed by law in civil causes, payable from the fund hereinafter created. In case of failure or neglect on the part of any person to comply with any order of the supervisor as hereinbefore provided, or any subpœna, or upon the refusal of any witness to testify to any matter regarding which he may lawfully be interrogated, or upon refusal or neglect to appear and attend at any proceeding or hearing on the day specified, after having received a written notice of not less than ten days prior to such proceeding or hearing, or upon his failure, refusal or neglect to produce books, papers or documents as demanded in said order or subpœna upon such day, such failure, refusal or neglect shall constitute a misdemeanor and each day's further failure, refusal or neglect shall be and be deemed to be a separate and distinct offense, and it is hereby made the duty of the district attorney of the county in which said proceeding, hearing or investigation is to be held, to prosecute all persons guilty of violating this section by continuous prosecution until such person appears or attends or produces such books, papers or documents or complies with said subpœna or order of the supervisor or chairman of the board of commissioners.

Final decision, and order by commissioners.

SEC. 13. Within ten days after hearing the evidence, the board of commissioners must make a written decision with respect to the order appealed from and in case the same is affirmed or modified, shall retain jurisdiction thereof until such time as the work ordered to be done by such order shall be finally completed. This written decision shall be served upon the owner or his agent and shall supersede the previous order of the supervisor. In case no written decision be made by said board of commissioners within thirty days after the date of notice by the supervisor as provided in section ten hereof, the order of the supervisor shall be effective and subject only to review by writ of certiorari from the superior court as provided in section fourteen hereof.

Repair of wells by supervisor. Review by superior court.

SEC. 14. On or before thirty days after the date of serving an order of the supervisor, provided for in section eight hereof, or in case of appeal to the board of commissioners, on or before thirty days after date of serving the decision of the board, as provided in sections twelve and thirteen hereof, or in the event review be taken of the order of the board of commissioners within ten days after affirmance of such order, the owner shall commence in good faith the work ordered and continue until completion. If the work has not been so commenced and continued to completion, the supervisor shall appoint agents as he deems necessary who shall enter the premises and perform the work. Accurate account of such expenditures shall be kept and the amount paid from the fund hereinafter created upon the warrant of the state controller. Any amount so expended shall constitute a lien against the property upon which the work is done. The decision of the board of commissioners in such case may be reviewed by writ of certiorari from the superior court of the county in which the district is situated, if taken within ten days after the service

of the order upon said owner, operator or agent of said owner or operator as herein provided; or within ten days after decision by the board of commissioners upon petitions by the supervisor. Such writ shall be made returnable not later than ten days after the issuance thereof and shall direct the district board of oil and gas commissioners to certify their record in the cause to such court. On the return day the cause shall be heard by the court unless for good cause the same be continued, but no continuance shall be permitted for a longer period than thirty days. No new or additional evidence shall be introduced in the court before the cause shall be heard upon the record of the district board of oil and gas commissioners. The review shall not be extended further than to determine whether or not

1. The commission acted without or in excess of its jurisdiction.
2. The order, decision or award was procured by fraud.
3. The order, decision, rule or regulation is unreasonable.
4. The order, decision, regulation or award is clearly unsupported by the evidence.

If no review be taken within ten days, or if taken in case the decision of the board is affirmed, the lien upon the property shall be enforced in the same manner as the other liens on real property are enforced, and shall first be enforced against the owner of the well, against the operator and against the personal property and fixtures used in the construction or operation thereof, and then if there be any deficiency against the land upon which the work is done, upon the request of the supervisor, the state controller must, in the manner provided in section forty-four of this act, bring an action for the enforcement of said lien.

Casing. Water shut off.

SEC. 15. It shall be the duty of the owner of any well now drilled, or that may be drilled in the State of California, on lands producing or reasonably presumed to contain petroleum or gas, to properly case such well or wells with metal casing, in accordance with methods approved by the supervisor, and to use every effort and endeavor in accordance with the most approved methods to effectually shut off all water overlying or underlying the oil or gas-bearing strata, and to effectually prevent any water from penetrating such oil or gas-bearing strata.

Whenever it appears to the supervisor that any water is penetrating oil or gas-bearing strata, he may order a test of water shut-off and designate a day upon which the same shall be held. Said order shall be in written form and served upon the owner of said well at least ten days prior to the day designated in said order as the day upon which said shut-off test shall be held. Upon the receipt of such order it shall be the duty of the owner to hold said test in the manner and at the time prescribed in said order.

Abandonment of well.

SEC. 16. It shall be the duty of the owner of any well referred to in this act, before abandoning the same, or before removing the rig, derrick or other operating structure therefrom, or removing any portion of the casing therefrom, to use every effort and endeavor in accordance with methods approved by the supervisor, to shut off and exclude all water from entering oil-bearing strata encountered in the well. Before any well is abandoned the owner shall give written notice to the supervisor, or his local deputy, of his intention to abandon such well and of his intention to remove the derrick or any portion of the casing from such well and the date upon which such work of abandonment or removal shall begin. The notice shall be given to the supervisor, or his local deputy, at least five days before such proposed abandonment or removal. The owner shall furnish the supervisor, or his deputy with such information as he may request showing the condition of the well and proposed method of abandonment or removal. The supervisor, or his deputy, shall before the proposed date of abandonment or removal, furnish the owner with a written order of approval of his proposal or a written order stating what work will be necessary before approval, to abandon or remove will be given. If the supervisor shall fail within the specified time to give the owner a written order such failure shall be considered as an approval of the owner's proposal to abandon the well, or to remove the rig or casing therefrom.

Commencement of drilling.

SEC. 17. The owner or operator of any well referred to in this act shall, before commencing the work of drilling an oil or gas well, file with the supervisor, or his local deputy, a written notice of intention to commence drilling. Such notice shall also contain the following information: (1) Statement of location and elevation above sea level of the floor of the proposed derrick and drill rig; (2) the number or other designation by which such well shall be known, which number or designation shall not be changed after filing the notice provided for in this section, without the written consent of the supervisor being obtained therefor; (3) the owner's or operator's estimate of the depth of the point at which water will be shut off, together with the method by which such shut-off is intended to be made and the size and weight of casing to be used; (4) the owner's or operator's estimate of the depth at which oil or gas producing sand or formation will be encountered.

After the completion of any well the provisions of this section shall also apply, as far as may be, to the deepening or redrilling of any well, or any operation involving the plugging of any well or any operations permanently altering in any manner the casing of any well; *and provided, further,* that the number or designation by which any well heretofore drilled has been known, shall not be changed without first obtaining a written consent of the supervisor.

Log of well. Prospect well.

SEC. 18. It shall be the duty of the owner or operator of any well referred to in this act, to keep a careful and accurate log of the drilling of such well, such log to show the character and depth of the formation passed through or encountered in the drilling of such well, and particularly to show the location and depth of the water-bearing strata, together with the character of the water encountered from time to time (so far as ascertained) and to show at what point such water was shut off, if at all, and if not, to so state in such log, and show completely the amounts, kinds and size of casing used, and show the depth at which oil-bearing strata are encountered, the depth and character of same, and whether all water overlying and underlying such oil-bearing strata was successfully and permanently shut off so as to prevent the percolation or penetration into such oil-bearing strata; such log shall be kept in the local office of the owner or operator, and together with the tour reports of said owner or operator, shall be subject, during business hours, to the inspection of the supervisor, or any of his deputies, or any of the commissioners of the district, except in the case of a prospect well as hereinafter defined. Upon the completion of any well, or upon the suspension of operations upon any well, for a period of six months if it be a prospect well, or for thirty days, if it be in proven territory, a copy of said log in duplicate, and in such form as the supervisor may direct, shall be filed within ten days after such completion, or after the expiration of said thirty-day period, with the field supervisor, and a like copy shall be filed upon the completion of any additional work in the deepening of any such well.

The state oil and gas supervisor shall determine and designate what wells are prospect wells within the meaning of this act and no reports shall be required from such prospect wells until six months after the completion thereof.

The owner or operator of any well drilled previous to the enactment of this act shall furnish to the supervisor or his deputy a complete and correct log in duplicate and in such form as the supervisor may direct, or his deputy, of such well, so far as may be possible, together with a statement of the present condition of said well.

Test of shut-off.

SEC. 19. It shall be the duty of the owner or operator of any well referred to in this act to notify the deputy supervisor of the time at which the owner or operator shall test the shut-off of water in any such well. Such notice shall be given at least five days before such test. The deputy supervisor or an inspector designated by the supervisor shall be present at such test and shall render a report in writing of the result thereof to the supervisor, a duplicate of which shall be delivered to the owner. If any test shall be unsatisfactory to the supervisor he shall so notify the owner or operator in said report and shall within five days after the completion of

such test, order additional tests of such work as he deems necessary to properly shut off the water in such well and in such order shall designate a day upon which the owner or operator shall again test the shut-off of water in any such well, which day may, upon the application of the owner, be changed from time to time in the discretion of the deputy supervisor.

Production reports.

SEC. 20. It shall be the duty of every person, association or corporation producing oil in the State of California, to file with the supervisor, at his request but not oftener than once in each month, a statement showing amount of oil produced during the period indicated from each well, together with its gravity and the amount of water produced from each well, estimated in accordance with methods approved by the supervisor, and the number of days during which fluid was produced from each well, the number of wells drilling, producing, idle or abandoned, owned or operated by said person, association or corporation; *provided*, that, upon request and satisfactory showing a longer interval may be fixed by the state oil and gas supervisor as to such reports in the case of any specific owner or operator.

This information shall be in such form as the supervisor may designate.

Penalty.

SEC. 21. Any owner or operator of a well referred to in this act, or employee thereof, who refuses to permit the supervisor, or his deputy, to inspect the same, or who wilfully hinders or delays the enforcement of this act, and every person, firm, or corporation, who violates any provision of this act, is guilty of a misdemeanor and shall be punishable by a fine of not less than one hundred dollars, or by imprisonment in the county jail for not less than thirty days, or by both such fine and imprisonment.

Police power of the state.

SEC. 21*a*. The charges hereinafter provided for are directed to be levied by the State of California as necessary in the exercise of its police power and to provide a means by which to supervise and protect deposits of petroleum and gas within the State of California, in which deposits the people of the State of California are hereby declared to have a primary and supreme interest.

Charges assessed.

SEC. 22. Charges levied, assessed and collected as hereinafter provided upon the properties of every person, firm, corporation or association operating any well or wells for the production of petroleum in this state, or operating any well or wells for the production of natural gas in this state which gas wells are situate on lands situate within two miles, as near as may be, of any petroleum or gas well the production of which is chargeable under this act, shall be used exclusively for the support and maintenance of the department of petroleum and gas hereinbefore created, and shall be assessed and levied by the state mineralogist, and collected in the manner hereinafter provided.

Charges on oil.

SEC. 23. Every person, firm, corporation or association operating any petroleum well or wells in this state shall annually pay a charge to the state treasurer at a uniform rate per barrel of petroleum produced for the preceding calendar year at the time and in the manner hereinafter provided, based upon a verified report as herein provided.

Charges on gas.

SEC. 24. Every person, firm, corporation or association operating any gas well or wells in this state shall annually pay a charge to the state treasurer based upon the amount of gas sold in the preceding calendar year, at a fixed rate per thousand cubic feet, at the times and in the manner hereinafter provided, based upon a verified report as herein provided.

Charges on land.

SEC. 25. Every person, firm, corporation or association owning any oil land, as determined by the supervisor, shall annually pay a charge to the state treasurer at the time and in the manner hereinafter provided, which charge shall be a uniform rate per acre. Said charge shall be based upon a verified report as provided herein; *provided, however,* that such lands so assessed shall not be called upon to pay more than one-tenth of the total charges or moneys proposed to be assessed, levied and collected under the provisions of this act for any one year.

SEC. 26. The charges assessed, levied and to be collected under the provisions of this act shall be in addition to any and all charges, taxes, assessments or licenses of any kind or nature paid by or upon the properties assessed hereunder.

Annual financial estimate.

SEC. 27. The state mineralogist shall annually, on or before the first Monday in March, acting in conjunction with the state board of control, make an estimate of the amount of moneys which shall be required to carry out the provisions of this act.

At the time of making such estimate, the state mineralogist shall report to the state board of control the amount of money in the petroleum and gas fund on the day such estimate is made, less the amount of money necessary for the support of the department of petroleum and gas for the remainder of the fiscal year, and the amount of such estimate shall in no event exceed the difference between the amount thus determined as remaining in the petroleum and gas fund at the end of the fiscal year and the sum of one hundred fifty thousand dollars.

Annual reports by owners.

SEC. 28. The state mineralogist shall prescribe the form and contents of all reports for making the charge or other purposes to carry out the intent and provision of this act, which form shall be mailed in duplicate to the person, firm, corporation or association owning property or assessed under the provisions of this act.

SEC. 29. Every person, firm, corporation or association chargeable under the provisions of this act, shall within ten days after the first Monday in March of each year, report to and file with the state mineralogist, a report in such form as said officer may prescribe, giving any and all items of information as may be demanded by said report, and necessary to carry out the provisions of this act, which report shall be verified by such person or officer as the state mineralogist may designate.

SEC. 30. If any person, firm, corporation or association chargeable under the provisions of this act shall fail or refuse to furnish the state mineralogist within the time prescribed in this act the verified report provided for in this act, the state mineralogist must note such failure or refusal in the record of assessments hereinafter in this act provided for, and must make an estimate of the petroleum or gas production, or landed area to be assessed of any such person, firm, corporation or association and must assess the same at the amount thus estimated and compute the charge thereon, which assessment and charge shall be the assessment and charge for such year. And if in the succeeding year any such person, firm, corporation or association shall again fail and refuse to furnish the verified report required by this act, the state mineralogist shall make an estimate as aforesaid, which estimate shall not be less than twice the amount of the estimate made by him for the previous year, and shall note such failure or refusal as above provided, and the said estimate so made shall be the assessment or charge for said year. In case of each succeeding consecutive failure or refusal the said state mineralogist shall follow the same procedure until a true statement or report shall be furnished.

Penalty.

SEC. 31. Any person, firm, corporation or association failing or refusing to make or furnish any report which may be required pursuant to the provisions of this act, or who wilfully renders a false or fraudulent report, shall be guilty of a misdemeanor and subject to a fine of not less than three hundred dollars, nor more than one thou-

sand dollars, or by imprisonment in the county jail not exceeding six months, or both such fine and imprisonment for each such offense.

Extension date filing reports.

SEC. 32. The state mineralogist may, for good cause shown, by order entered upon his minutes, extend for not exceeding thirty days, the time fixed in this act for filing any report herein provided for.

Rate of assessment.

SEC. 33. On or before the third Monday before the first Monday in July of each year, the state mineralogist shall determine the rate or rates which shall produce the sums necessary to be raised as provided in section twenty-seven of this act. Within the same time the said state mineralogist shall extend into the proper column of the record of assessments hereinafter provided for, the amount of charges due from each person, firm, corporation or association.

SEC. 34. Between the first Monday in March and the third Monday before the first Monday in July in each year, the state mineralogist must assess and levy the charges as and in the manner provided for in this act. The assessments must be made to the person, firm, corporation or association owning or operating the property subject to assessment hereunder on the first Monday in March. If the name of the owner is unknown to the state mineralogist, such assessment must be made to unknown owners. Clerical errors occurring or appearing in the name of any person, firm, corporation or association whose property is properly assessed and charged, or in the making, or extension of any assessment or charge upon the records, which do not affect the substantial rights of the payer, shall not invalidate the assessment or charge.

Equalization.

SEC. 35. The state mineralogist and the chairman of the state board of control and the chairman of the state board of equalization shall constitute a board of review, correction and equalization, and shall have all the powers and perform such duties as usually devolve upon a county board of equalization under the provisions of section three thousand six hundred seventy-two of the Political Code. The state mineralogist shall act as secretary of said board, and shall keep an accurate minute of the proceedings thereof. Said board of review, correction and equalization shall meet at the state capitol on the third Monday before the first Monday in July of each year, and remain in session from day to day until the first Monday in July for the purpose of carrying out the provisions of this section.

Publication of assessment notice.

SEC. 36. On the third Monday before the first Monday in July of each year the state mineralogist shall cause to be published a notice, one or more times, in a daily, or weekly, or semiweekly newspaper of general circulation published in the counties of Fresno, Kern, Los Angeles, Orange, Ventura and Santa Barbara, and such other counties as may contain lands or produce oil or gas charged under and pursuant to the terms and provisions of this act, if one be published therein, otherwise in a newspaper of general circulation published in the county nearest to such county designated herein in which no such paper is published, that the assessment of property and levy of charges under and in pursuance of this act has been completed and that the records of assessments containing the charges due will be delivered to the state controller on the first Monday in July, and that if any person, firm, corporation or association is dissatisfied with the assessment made or charge fixed by the state mineralogist, he or it may, at any time before said first Monday in July, apply to said board of review, correction and equalization to have the same corrected in any particular. The said board shall have the power at any time before said first Monday in July to correct the record of assessments and may increase or decrease any assessment or charge therein if in its judgment the evidence presented or obtained warrants such action. Costs of such publication in any county shall be paid from the petroleum and gas fund; *provided, however,* that the omission to publish said notice as hereinbefore

and in this section provided, shall not affect the validity of any assessment levied under or pursuant to the provisions of this act.

Record of assessment.

SEC. 37. The state mineralogist must prepare each year a book in one or more volumes, to be called the "Record of assessments and charges for the petroleum and gas fund," in which must be entered, either in writing or printing, or both writing and printing, each assessment and levy or charge made by him upon the property provided to be assessed and charged under this act, describing the property assessed, and such assessments may be classified and entered in such separate parts of said record as said state mineralogist shall prescribe.

SEC. 38. On the first Monday in July the state mineralogist must deliver to the state controller the record of assessments and charges for the petroleum and gas fund, certified to by said state mineralogist, which certificate shall be substantially as follows: "I, _____, state mineralogist, do hereby certify that between the first Monday in March and the first Monday in July, 19___, I made diligent inquiry and examination to ascertain all property and persons, firms, corporations and associations subject to assessment for the purpose of the petroleum and gas fund as required by the provisions of the act of legislature approved June 10, 1915, providing for the assessment and collection of charges for oil protection; that I have faithfully complied with all the duties imposed upon me by law; that I have not imposed any unjust or double assessment through malice or ill will, or otherwise; nor allowed any person, firm, corporation or association or property to escape a just assessment or charge through favor or regard, or otherwise." But the failure to subscribe such certificate to such record of assessments and charges for oil protection, or any certificate, shall not in any manner affect the validity of any assessment or charge.

Payment of charges.

SEC. 39. The charges levied and assessed under the provisions of this act shall be due and payable on the first Monday in July in each year, and one-half thereof shall be delinquent on the sixth Monday after the first Monday in July at six o'clock p.m. and unless paid prior thereto, fifteen per cent shall be added to the amount thereof, and unless paid prior to the first Monday in February next thereafter at six o'clock p.m., an additional five per cent shall be added to the amount thereof, and the unpaid portion, or the remaining one-half of said charges shall become delinquent on the first Monday in February next succeeding the day upon which they become due and payable, at six o'clock p.m.; and if not paid prior thereto five per cent shall be added to the amount thereof.

Publication of notice of payments due.

SEC. 40. Within ten days after the receipt of the record of assessments and charges for oil protection, the state controller must begin the publication of a notice to appear daily for five days, in one daily newspaper of general circulation published in each of the counties of Fresno, Kern, Los Angeles, Orange, Ventura and Santa Barbara, and such other counties as may contain lands or produce oil or gas charged under or pursuant to the terms and provisions of this act, if one be published therein, otherwise for at least two times in a weekly or semiweekly paper of general circulation published therein, or if there be neither a daily nor weekly nor semiweekly paper of general circulation published in any one of such counties, then the publication of the notice for such county shall be made in a similar manner in a newspaper of general circulation published in the county nearest such county, specifying: (1) That he has received from the state mineralogist the record of assessments and charges for oil protection; (2) that the charges therein assessed and levied are due and payable on the first Monday in July and that one-half thereof will be delinquent on the sixth Monday after the first Monday in July at six o'clock p.m., and that unless paid to the state treasurer at the capital prior thereto, fifteen per cent will be added to the amount thereof, and unless paid prior to the first Monday in February next thereafter at six o'clock p.m., and additional five per cent will be added to the amount thereof; and that the remaining one-half of said charges

will become delinquent on the first Monday in February next succeeding the day upon which they become due and payable, at six o'clock p.m. and if not paid to the state treasurer at the capital prior thereto, five per cent will be added to the amount thereof. Costs of such publication in any county shall be paid from the petroleum and gas fund.

Charges become lien.

SEC. 41. The assessments and charges levied under the provisions of this act shall constitute a lien upon all the property of every kind and nature belonging to the persons, firms, corporations and associations assessed under the provisions hereof, which lien shall attach on the first Monday in March of each year. Such lien shall be enforced and said charges collected by an action by the state controller as provided in section forty-four of this act.

Charges payable to treasurer.

SEC. 42. All charges assessed and levied under the provisions of this act shall be paid to the state treasurer upon the order of the state controller. The controller must mark the date of payment of any charge on the record of assessments for the petroleum and gas fund and shall give a receipt for such payment in such form as the controller may prescribe. Errors appearing upon the face of any assessment on said record of assessments or over charges may be corrected by the controller by and with the consent of the state board of control, in such manner and at such time as said controller and said board shall agree upon.

Protest of charges.

SEC. 43. Any person, firm, corporation or association claiming and protesting as herein provided that the assessment made or charges assessed against him or it by the state mineralogist is void, in whole or in part, may bring an action against the state treasurer for the recovery of the whole or any part of such charges, penalties or costs paid on such assessment, upon the grounds stated in said protest, but no action may be brought later than the third Monday in February next following the day upon which the charges were due, nor unless such person, firm, corporation or association shall have filed with the state controller at the time of payment of such charges, a written protest stating whether the whole assessment or charge is claimed to be void, or if a part only, what part, and the grounds upon which such claim is founded, and when so paid under protest the payment shall in no case be regarded as voluntary.

Whenever, under the provisions of this section, an action is commenced against the state treasurer, a copy of the complaint and of the summons must be served upon the treasurer, or his deputy. At the time the treasurer demurs or answers, he may demand that the action be tried in the superior court of the county of Sacramento, which demand must be granted. The attorney employed by the state oil and gas supervisor must defend such action; *provided, however,* the said mineralogist may at the request of the said oil and gas supervisor employ additional counsel, the expense of which employment shall be paid from the petroleum and gas fund. The provisions of the Code of Civil Procedure relating to pleadings, proofs, trials and appeals are applicable to the proceedings herein provided for.

A failure to be in such action within the time herein specified shall be a bar against the recovery of such charges. In any such action the court shall have the power to render judgment for the plaintiff for any part or portion of the charge, penalties, or costs found to be void and so paid by plaintiff upon such assessment.

Delinquent charges.

SEC. 44. The state controller shall, on or before the thirtieth day of May next following the delinquency of any charge as provided in this act, bring an action in a court of competent jurisdiction, in the name of the people of the State of California, in the county in which the property assessed is situated, to collect any delinquent charges or assessments, together with any penalties or costs, which have not been paid in accordance with the provisions of this act and appearing delinquent upon the records of assessments and charges for the petroleum and gas fund in this action provided for.

The attorney for the state oil and gas supervisor shall commence and prosecute such action to final judgment and the provisions of the Code of Civil Procedure relating to service of summons, pleadings, proofs, trials and appeals are applicable to the proceedings herein provided for. The state mineralogist may employ additional counsel to assist the attorney for the state oil and gas supervisor, and the expense of such employment shall be paid from the petroleum and gas fund.

Payments of the penalties and charges, or amount of the judgment recovered in such action must be made to the state treasurer. In such actions the record of assessment and charges for oil protection, or a copy of so much thereof as is applicable in said action, duly certified by the controller showing unpaid charges against any person, firm, corporation or association assessed by the state mineralogist is prima facie evidence of the assessment upon the property, the delinquency, the amount of charges, penalties, and costs due and unpaid to the state, and that the person, firm, corporation or association is indebted to the people of the State of California in the amount of charges and penalties therein appearing unpaid and that all the forms of law in relation to the assessment of such charges have been complied with.

First assessment, March, 1916.

SEC. 45. The first assessment under the provisions of this act shall be as of the first Monday in March, nineteen hundred sixteen, and the reports of petroleum production and sales of gas herein provided to be assessed shall be reported for the calendar year ending December thirty-first, nineteen hundred fifteen. The lands herein provided to be assessed and charged shall be assessed to the owners thereof as of the first Monday in March, nineteen hundred sixteen.

Disposal of funds.

SEC. 46. All the moneys heretofore paid to the state treasurer under or pursuant to the provisions of this act and deposited to the credit of the oil protection fund, shall be withdrawn from said fund, which is hereby abolished, and deposited to the credit of the petroleum and gas fund which is hereby created. All of the moneys hereafter paid to the state treasurer under or pursuant to the provisions of this act shall be deposited to the credit of the petroleum and gas fund. All moneys in such fund shall be expended under the direction of the state mineralogist, drawn from such fund for the purpose of this act upon warrants drawn by the controller of the state, upon demands made by the state mineralogist, and audited by the state board of control. Of the moneys in said petroleum and gas fund, when such action has been authorized by the state board of control, the state mining bureau may withdraw, without at the time furnishing vouchers and itemized statements, a sum not to exceed five hundred dollars, said sum so drawn to be used as a revolving fund where cash advances are necessary. At the close of each fiscal year, or at any other time, upon demand of the board of control, the moneys so drawn shall be accounted for and substantiated by vouchers and itemized statements submitted to and audited by the board of control.

SEC. 47. All moneys received in repayment of repair work done under the order and direction of the supervisor as hereinbefore provided, shall be returned and credited to the petroleum and gas fund.

Annual report by supervisor.

SEC. 48. On or before the first day of October of each and every year the supervisor shall submit a report in writing to the state mineralogist showing the total number of barrels of petroleum produced in each county in the state during the previous calendar year, together with the total cost of said department for the previous fiscal year and the net amount remaining in the petroleum and gas fund available for the succeeding fiscal year's expense, also the total amount delinquent and uncollected from any assessments or charges levied under or pursuant to the provisions of this act. Such report shall also include such other information as the supervisor may deem advisable. The state mineralogist shall make public such statements promptly after receipt of the same from the supervisor for the benefit of all parties interested therein.

Recording of leases.

SEC. 49. The owner or operator of any lands or tenements subject to assessment under this act shall, within six months after this act goes into effect, file with the supervisor a certificate which shall contain the names of all the parties claiming an interest in or to said lands and full description of the property and the names of all parties in interest where such interest is held by lease, license or assignment.

Definitions.

SEC. 50. Whenever the term "supervisor" is used in this act it shall be taken to mean the "state oil and gas supervisor," the term "oil" shall include "petroleum," the term "petroleum" shall include "oil," the term "gas" shall mean natural gas coming from the earth, the term "operator" shall mean any person, firm or corporation drilling, maintaining, operating, pumping, or in control of a well in any territory which the supervisor determines to be oil or gas producing territory, the term "owner" shall include "operator" when any oil or gas well is operated or has been operated or is about to be operated by any person, firm or corporation other than the owner thereof, and the term "operator" shall include "owner" when any such well is or has been or is about to be operated by or under the direction of the owner, except that all the provisions of this act relating to assessments for the purposes of this act based upon the annual production of oil or petroleum or sale of gas, as set forth in sections twenty-two to forty-five, inclusive of this act, shall apply only to a person, firm or corporation operating an oil or petroleum or gas well, and shall not apply to the owner of such well if some person, firm or corporation, other than such owner, has been actually operating the well during the whole period for which such annual charge is made, but in the event that the actual operation of any such well changes hands during such period, the charge shall be apportioned upon the basis of the oil or petroleum or gas produced, and the lien provided for in section forty-one of this act shall be a lien against the property of each and all such operators.

Appropriation first year.

SEC. 51. There is hereby appropriated out of any moneys in the state treasury, not otherwise appropriated, the sum of twenty thousand dollars which said sum shall be immediately transferred by the state controller on the books of his office from the general fund to the "oil protection fund" created by section forty-six of this act.

The above mentioned fund shall be available for the uses of the state mineralogist for the maintenance of the department of petroleum and gas and for the necessary expenses of the controller in carrying out the provisions of this act. When the collections paid to the state treasurer, as herein provided, equal the sum of thirty thousand dollars then said sum of twenty thousand dollars shall be re-transferred from the oil protection fund to the general fund. The moneys received into the state treasury through the provisions of this act are hereby appropriated for the uses and purposes herein specified.

Constitutionality.

SEC. 52. If any section, subsection, sentence, clause or phrase of this act is for any reason held to be unconstitutional, such decision shall not affect the validity of the remaining portions of this act. The legislature hereby declares that it would have passed this act, and each section, subsection, sentence, clause, and phrase thereof, irrespective of the fact that any one or more other sections, subsections, sentences, clauses, or phrases be declared unconstitutional.

Incorporated cities.

SEC. 53. This act shall be liberally construed to meet its purposes and the supervisor shall have all powers which may be necessary to carry out the purposes of this act, but the provisions of this act shall not apply to any land or wells situated within the boundaries of an incorporated city where the drilling of oil wells is prohibited.

Repeal of previous law.

SEC. 54. That certain act entitled "An act to prevent injury to oil, gas or petroleum-bearing strata or formations by the penetration or infiltration of water therein," approved March 20, 1909, together with all acts amendatory thereof and supplemental thereto and all acts in conflict herewith are hereby repealed. Nothing herein shall be construed as affecting the provisions of the act of June 16, 1913, establishing a state mining bureau.

TO PREVENT WASTING OF NATURAL GAS.

An act prohibiting the unnecessary wasting of natural gas into the atmosphere; providing for the capping or otherwise closing of wells from which natural gas flows; and providing penalties for violating the provisions of this act.

[Approved March 25, 1911.]

The people of the state of California, represented in senate and assembly, do enact as follows:

SECTION 1. All persons, firms, corporations and associations are hereby prohibited from wilfully permitting any natural gas wastefully to escape into the atmosphere.

SEC. 2. All persons, firms, corporations or associations digging, drilling, excavating, constructing or owning or controlling any well from which natural gas flows shall upon the abandonment of such well, cap or otherwise close the mouth of or entrance to the same in such a manner as to prevent the unnecessary or wasteful escape into the atmosphere of such natural gas. And no person, firm, corporation or association owning or controlling land in which such well or wells are situated shall wilfully permit natural gas flowing from such well or wells, wastefully or unnecessarily to escape into the atmosphere.

SEC. 3. Any person, firm, corporation or association who shall wilfully violate any of the provisions of this act shall be deemed guilty of a misdemeanor, and upon conviction thereof shall be punished by a fine of not more than one thousand dollars or by imprisonment in the county jail for not more than one year, or by both such fine and imprisonment.

SEC. 4. For the purposes of this act each day during which natural gas shall be wilfully allowed wastefully or unnecessarily to escape into the atmosphere shall be deemed a separate and distinct violation of this act.

SEC. 5. All acts or parts of acts in conflict herewith are hereby repealed.

SEC. 6. This act shall take effect immediately.

OFFICE BUILDINGS.

Arrangements have been made for the erection of office buildings on leased land at the towns of Taft and Coalinga. The buildings will provide room for the assembling and displaying of peg models useful to all operators in the fields. Fireproof vaults will provide for the safekeeping of invaluable records of underground conditions.

SPECIAL REPORTS ON TECHNICAL AND MECHANICAL SUBJECTS.

It is aimed to make the annual report of the supervisor contain authoritative statements on subjects of interest to progressive oil operators. All members of our staff are encouraged to prepare articles on either mechanical or technical matters which have not previously been published. Such articles are edited by the supervisor, with the aid of the deputies, with a view to attaining correctness and avoiding useless statements. Similar articles by persons not regularly in the service of the department will be given space in the report under the same conditions.

METHODS AND REASONS FOR OIL WELL SHOOTING.

By M. J. Kirwan, Deputy Supervisor.

Previous to the year 1910 oil wells in California were generally shot in the following manner:

A shell, or container, was made of ordinary galvanized, light sheet iron. Sticks of stock 60% dynamite, usually from $\frac{7}{8}$" to $1\frac{1}{8}$" in diameter by 8" in length, were loaded into the shell and lowered into the well to the desired depth by the sand line. The charge of dynamite was detonated by use of a blasting cap, lighted with fuse. The length of the fuse was regulated so as to allow sufficient time to lower the shell to the desired shooting depth before detonation. The diameter of the shell was governed by the size of the casing through which it had to be run and the length of the shell by amount of dynamite used.

In some instances a piece of casing was used for a container of the dynamite. This kind of a container was lowered into the well to the desired depth by an attached string of tubing extending to the surface. The charge of dynamite exploded by dropping a squib shot through the tubing. Squib shots usually consist of a short piece of pipe about 1" in diameter, containing one or two sticks of dynamite with cap and lighted fuse attached. The explosion of the squib shot detonated the main charge of dynamite previously lowered into the well.

The foregoing described methods of shooting wells are still used in some cases. The results obtained by employing such methods have, in many instances, been unsatisfactory and in some cases detrimental to the well on account of casing having been shot off at the wrong depth, as a result of premature explosion. There are cases in which workmen engaged in shooting have been killed or injured while using one of these methods, on account of accidental explosions at the surface.

The modern method of shooting oil wells is accomplished by the use of a specially prepared blasting gelatin, an explosive much safer than dynamite or nitroglycerine, on account of the insensitiveness to heat, friction or concussion. Straight blasting gelatin is a nitroglycerine and guncotton composition and is not especially adapted to well shooting, on account of its tendency to harden shortly after manufacture so that it can not be made to conform to the size or shape of the desired shell or container.

Blasting gelatin, for well-shooting purposes, is prepared by the addition of wood pulp in certain proportions in order to make it plastic so that it can be gotten into shape for the container.

METHOD OF SHOOTING WELLS WITH BLASTING GELATIN.

Electric detonators which are especially prepared to withstand the pressure to be contended with in oil-well shooting, are embedded in the blasting gelatin and then connected in series so as to insure a simultaneous explosion of the entire charge. The torpedo or container, when loaded, is lowered into the well to the shooting depth by the sand line, and the waterproof leading wires from the electric detonators are connected to a blasting machine, or power circuit, at the surface. The charge of gelatin is then detonated by electric current at the desired moment.

Following is a table giving the amount of blasting gelatin held by various sized torpedoes per foot. The diameter of the torpedo is regulated so as to carry the desired amount of explosive per foot. The largest diameter of a torpedo used is usually about one inch less than the diameter of the smallest casing through which it has to be run.

Diameter of torpedo in inches	Pounds per foot	Diameter of torpedo in inches	Pounds per foot
1	½	4½	11⅝
1¼	9/10	5	14½
1½	1¼	5½	17½
1¾	1⅝	6	21
2	2¼	6½	24⅝
2¼	2⅝	7	28⅝
2½	3½	7½	33
2⅝	4¼	8	37½
3	5¼	8½	42½
3¼	6	9	49
3½	7	9½	53
3¾	8¼	10	58
4	9½		

The amount of explosive used should be regulated by the physical condition of the well between the shooting depth and height of fluid above the shooting point and results desired. In some wells where shooting is recommended by the State Mining Bureau, the approximate amount of explosive to be used is specified. In most cases where shooting is to be done it is advisable for the well owner to consult with an expert shooter relative to the exact amount of explosive which should be used in each shot.

An advantage of shooting with gelatin is that the force of the explosion may be directed by the spacing and placing of the detonators. Blasting gelatin generally used in California well shooting generates 1300 volumes of gas under an initial pressure of 15 tons per square inch. The definition of the word "explosion" used herein is as follows: "The release of a large volume of gas generated under great pressure."

During drilling operations various tools or portions of casing may be lost and obstruct or prevent further drilling before removal. In many

cases it would be more economical to displace such obstructions by shooting, rather than drill them up or fish them out.

It is advisable to shoot in the majority of wells where oil- and water-bearing formations are penetrated by casing which can not be removed, and in which it becomes necessary to plug between certain depths.

In practically every case it is necessary to shoot wells which have one or more strings of sidetracked casing, which may serve to conduct water into or between oil-bearing formations, in order that all holes may be converted into one large one and plugged between certain depths to prevent the passage of water. It sometimes becomes necessary to shoot with a small amount of explosive to create a "pocket" in which to make a shot large enough to obtain the desired results. In cases of this kind, where the "pocket" has been made, the torpedoes are made of comparatively short lengths connected by wire so as to allow them to pass and rest alongside of each other in the hole. This method of shooting is employed where there is sidetracked casing, which may be a number of feet from the hole in which the shooting is done and where it is necessary to shoot all holes together in order to plug with cement.

Probably most of the oil-well shooting is done for the purpose of severing casing at a certain depth in order to permit removal of the upper portion. There are instances in which casing has been shot off inside of other casing without rupturing the outer casing. This was done by the use of a coupling locator below which was attached a small charge of explosive calculated for the requirements of such work. A coupling locator is a tool which resembles a latch-jack and is run on the sand line. After a collar or coupling on the casing, nearest to the desired shooting depth, has been located, the charge of explosive is detonated opposite such collar.

Wells penetrating hard formations may be shot instead of under-reamed, in order to allow casing to follow the tools. "Crooked" hole in drilling wells, caused by hard formations standing at a steep angle with the horizontal, may be straightened by shooting between proper depths.

Shooting has been resorted to instead of perforation to permit fluid to enter through the oil string, in some wells.

The production of some wells has been increased by shooting in hard or close-grained formation, shattering it so as to allow fluid to enter the well more readily.

Thanks are due to Messrs. C. H. Allison and A. Leslie Oliver for assistance in preparing this information for publication.

A METHOD OF REMOVING CASING AND PLUGGING WELLS USED IN THE KERN RIVER FIELD.

By G. McGregor, Petroleum Engineer.

Shooting pipe for the purpose of plugging is not looked on with much favor in the Kern River field, for two reasons: First, there are so many sands with thin shale streaks between that it would be a very expensive piece of work to separate each oil sand by shooting in the hard strata between them and putting in a bridge. In the second place the lower shales do not seem to resist the action of water. When drilled into they appear to be tough but after being subjected to the action of water, they seem to become softened very much as lime does upon becoming air slacked. Consequently, they do not make ideal places in which to put cement plugs.

Added to the above is the uncertainty of the records, which are so unreliable that it is unusual to find the formations in a well as they appear on the log. Consequently, one could never be sure of placing a shot where it would be of any use.

The alternative has been the method employed by the Peerless Oil Company and, with minor modifications, by other companies in this field.

The method is as follows: The casing is cut in short lengths, usually about 5 feet long, and then starting with the bottom piece is ripped. The ripper is run as long as it will take hold, usually three to five rips being cut in each piece of casing. The ripper is then raised to the next cut and the process repeated until the entire joint is thoroughly ripped. The ripper is next raised above the collar which is ripped or knocked off. The next step is to run in with the tools, get on top of this ripped casing and pound it down. In some cases a 20′ joint of pipe has been pounded down until it only occupied 3′ of hole.

In conjunction with this method, clay and cement are used and the open hole below the unripped pipe is filled and tamped. Then the process is repeated with the next joint of casing until the desired height is reached. In this way a solid clay plug is put in, mudding up the sand and re-inforcing the shales as it is built.

Mr. D. W. Wells, of the Peerless Oil Company, has used this method almost exclusively among the wells worked on, being numbers 5, 26, 33, 41, 42, 43, 49, 53, 54 and 67.

The method is only employed in plugging wells where it is impossible to pull the casing. No attempt is made to replace shooting by this method where it is desired to sidetrack the casing or to loosen it for pulling.

An amusing incident encountered by this department in connection with the above method illustrates the tendency of some superintendents to cling to established methods and refuse to even consider a new procedure. The method was specified by the department as part of the work on a certain well in the Kern River field but the superintendent entered emphatic protest, stating that the method was impracticable if not a physical impossibility, showing that he had not taken the trouble to keep informed on present day operations in plugging wells used at near-by properties.

METHOD OF MUDDING WELLS AS PRACTICED IN THE KERN RIVER FIELD.

By G. McGregor, Petroleum Engineer.

For many years it has been a matter of common knowledge that large areas in the Kern River field have been greatly damaged by water flooding the producing sands and, while generally admitted to be a menace, concerted and concentrated action to remedy the evil was not undertaken. This was probably due to two causes: First, definite methods of combating the water were not in vogue; and second, the period of depression in the oil industry during which the receipts were so light that smaller operators did not feel justified in spending any considerable sum for repairs.

In the last few years, however, the recognition of the use of clay as a remedy and the increase in the price of oil has caused much repair work to be undertaken and in nearly every instance the work done has been very beneficial to the company doing the work, and in many cases the neighbors have profited by the work done.

The methods in which wells are plugged with clay may be roughly divided into two classes:

1. Where the clay is mixed in the well; and
2. Where the clay is mixed on the surface and placed in the well in liquid form.

Advocates of both systems are very staunch in their support of their particular method.

In the first method cable tools are used, being allowed to swing at the particular spot where it is desired to mud. The clay is then shoveled dry, or slightly moistened, into the top of the casing along with a constant stream of water. The water serves a double purpose of preventing the clay from "bridging" when it strikes the fluid level and also to a certain extent increases the head of water in the casing, thus helping to carry the clay out into the formations. The action of the tools swinging in the open hole is similar to the action of rotary drill-pipe and as the clay settles down around the tools it is pounded back into the formation. Care must be taken that the tools do not become "mudded up" or that circulation does not stop while clay is being put in.

The Del Rey Oil Company used this method on their well No. 1, Section 5, Tp. 29 S., R. 28 E., M. D. B. & M. The well had to be redrilled and all the mudding done through 5⅜" casing, the hole being plugged from 1095 feet up to 664 feet where a cement cap was placed.

Approximately 120 feet of oil sands were mudded off, the plan being to mud off the sands on the way down so as to keep the casing free and then put in a solid plug, as the pipe was withdrawn. About 850 cubic

yards of clay, 4½ tons of iron cuttings and 25 wagon loads of manure were put in. The work lasted three months and cost in the neighborhood of $3500 exclusive of the cost of a new derrick.

Various companies using the second method, namely, mixing the mud before it is put in the well, differ slightly in their methods.

The Associated Oil Company uses an ordinary concrete mixer to mix the clay which is then pumped into the well through a string of 3″ tubing. The first step is to clean the well to bottom and split up the old pipe in the well in order to allow the mud free access to the walls of the hole. A string of tubing is then inserted and the well pumped full of the mud fluid. The fluid in the hole is subjected to pump pressure. The well is then, by having tight head in the casing and gas clamps around it, allowed to stand under pressure to test the job. If the mud does not break away under the pressure test, the bottom of the tubing is placed in the lowest clay stratum where it is desired to cement, and after releasing a part of the pressure a certain amount of cement is pumped into the clay stratum. This process is repeated in all the strata in which it is desired to cement.

This system was used on M. & S. Well No. 10, Section 29, Tp. 28 S., R. 28 E., M. D. B. & M., which had approximately 170 feet of exposed oil sands. About 500 cubic yards of clay and 190 sacks of cement were used on the job which required only nine days, and cost approximately $2000.

The Standard Oil Company has a specially constructed mud mixer mounted on a wagon bed which is moved from well to well. The mixer consists of a box with a shaft running lengthwise to which are fastened paddles. The shaft is driven by a chain drive from an ordinary well engine which is also moved about and connected with the steam line at the well to be mudded. A stream of water is allowed to run into the box and the clay shoveled in where it is thoroughly mixed. The mud is allowed to run out at one end of the box in any desired thickness. A trough extends from the mud-mixer to the well and the mud flows in by gravity.

When it is desired to "mud" a well, it is always cleaned out to bottom, or if the casing is in such shape that this is impossible, the well is redrilled. As the mud flows into the well, the lower string of casing is lifted frequently until a place is found where the mud goes away freely. As the hole fills with mud, the casing is withdrawn and the well filled to the top. An air line is then connected to the casing and air pressure of 275 lbs. per square inch put on the top of the mud column to force the mud down the well and thence back into the formations. In some cases, the column can be forced down a distance of 300 feet. The well is then filled to the top again and the process repeated until the hole will not take any more mud.

This system was used on Well No. 38, "M. C. No. 1.", Section 5, Tp. 29 S., R. 28 E., M. D. B. & M., where about 450 cubic yards of clay was put in. This work took about 13 days and cost in the neighborhood of $4150. The exposed oil sands were about 330 feet thick.

The Kern River Oilfields of California Ltd., uses still a different system in that they mix the mud in a large vat with steam brought into contact with the clay by means of a perforated coil of pipe and men using hoes. The liquid mud is then pumped into the well.

In all cases work commences at the bottom of the well, although in some cases it is necessary to drill a new hole beside the old one to get down to the original bottom depth. In some cases it is not necessary to fill the hole to the top because when circulation of water is stopped, the upper sands cave in on top of the mud and act as a cap while pressure is being applied to the mud below. In the cases where the hole is filled to the top, the well is allowed to stand under pressure. Sometimes the formations give way and the column of mud drops, when the hole is again filled and the pressure applied until a stable condition is obtained.

Well No. 2-B of the Kern River Oilfields of California, Ltd., on Section 33, Tp. 28 S., R. 28 E., M. D. B. & M., is a good example of the latter method. This well which had originally been drilled to 980 feet but in some former work had been plugged back to 896 feet, supposedly shutting off the water below that depth, was redrilled to 896 feet and cased to 883 feet. Tubing was run to a depth of 886 feet and mud was pumped into the well. After putting in 16 cubic yards, the clay showed in the adjoining well—No. 3-B. After 220 cubic yards had been pumped in the pump gauge showed pressure from time to time. There were 430 cubic yards pumped in through the tubing which was pulled, and 3 cubic yards more were put in. This well had about 260 feet of oil sand exposed. The cost of labor was about $700 and material $74, and the time about 57 days. No charge was made for casing on this job as enough casing was recovered from the old well to redrill with. This well was afterwards cleaned out to about 650 feet and put to pumping.

Another very interesting case was well No. 1-LL of the Kern River Oilfields of California, Ltd., on the same section. In this case a new hole was drilled about 8 feet from the original well. The old hole was 838 feet deep and the new well was drilled to 829 feet. The $7\frac{5}{8}$" casing was kept nine feet from bottom and circulation was obtained after pumping water into the well under pressure of 75 lbs. per square inch for fifteen minutes. As soon as circulation was obtained, the water gravitated into the hole. A packer was then set and after 120 cubic yards of clay had been pumped in, the pump pressure ran up to 375

pounds per square inch. The packer was then taken out and the $7\frac{5}{8}''$ casing cut off at 652 feet, the upper portion pulled out and the packer again set at the cut-off (or 652′). After pumping in six more cubic yards (making a total of 126), the adjoining well (No. 2-L) began to show clay and a decrease in the amount of water pumped by No. 2-L was noticed. When 24 more cubic yards of clay (making a total of 150 yards) had been pumped in, the pump gauge again began to show pressure and the mud came to the surface between the $13\frac{1}{2}''$ casing and the $9\frac{5}{8}''$ casing, showing that in all probability the mud had broken through into the old hole and had then come back into the new above where the packer was set. The packer was then withdrawn. Well No. 2-L showed such a rapid decrease in water that it was taken off air and put on the beam as there was not enough fluid to handle with air. The water handled in No. 2-L decreased from about 1200 barrels daily to approximately 200 barrels daily. About two months later the water again broke in so work was resumed and 25 cubic yards more clay were pumped in which apparently cured the trouble. Approximately 175 cubic yards of clay were used in this hole which had about 400 feet of exposed oil sand. The work took about three weeks and cost in the neighborhood of $2687 of which $1400 was for labor and the remainder for material.

None of the above wells had flowing water to contend with although in practically every case they had to contend with the "bottom" water, which, while not under sufficient head to make it flow, still raises the fluid level high in the hole and seems inexhaustible. The depth of these holes ranged from about 700 feet to 1400 feet.

The foregoing cases are merely cited as typical examples of the various methods used and do not in any way represent the amount of repair work done in the field, as each of the above companies has worked on numerous other wells, and other companies have been and are, at the present time, engaged in repair work. Among these are: The Peerless Oil Company, Virginia Oil Company, Apollo Oil Company, Alma Oil Company, Kern River Oil Company, Tejon Oil Company, Calex Oil Company, Calloma Oil Company, and others.

COLLECTION OF FUNDS BY ASSESSMENT.

The collection of funds during the past fiscal year was made as provided in the original statute of 1915, chapter 718. Briefly, the details are as follows:

The money received from collection of the assessment comprises the oil protection fund and is used for two purposes: First, for the supervision by the Petroleum Department of the State Mining Bureau; and second, for the repair of oil wells. The rates, shown on the accompanying statement and used in determining the various items, are determined in accordance with sections 23, 24, 25, 46 and 47 of the said statute. The detailed method is as follows:

The sum of $45,000 is annually available for the support and maintenance of the department. One-tenth of the above mentioned sum of $45,000 is levied upon the oil land of the state. The remaining nine-tenths is levied upon the oil produced and the gas produced and sold. For the purpose of this assessment 10,000 cubic feet of gas is considered equal to one barrel of oil. The amounts of land, oil and gas and the number of producing wells in the various counties were determined to be as follows:

County	Land (acres)	Oil (bbls.)	Gas (10 M)	Wells (No.)
Fresno	12,703	14,048,105	5,437	944
Kern	56,122	52,278,238	1,229,680	4,246
Los Angeles	2,174	2,400,811	63,584	531
Orange	3,297	13,048,749	324,267	458
Ventura	1,523	904,013	----------	332
Santa Barbara	9,808	4,361,241	82,090	349
San Luis Obispo	772	5,670	----------	2
Santa Clara	80	16,368	----------	11
Totals	86,479	87,063,195	1,705,058	6,873

The money which was previously collected to be used in repairing wells is available for use only in the county where collected. Expenditure in repairing wells is to be repaid by satisfaction of a lien upon the property where the work is done and therefore little or no further assessment is to be expected for repairs. The assessment for the repair work was levied in the same manner as that for supervision, namely, one-tenth on the oil land and the remainder on oil produced and gas produced and sold. The rates applied in levying the total assessment are $.052 per acre of oil land and $.000456 per barrel of oil or per 10,000 cubic feet of gas.

FINANCIAL STATEMENT.

By W. W. THAYER, Secretary.

CALIFORNIA STATE MINING BUREAU.

Statement of Receipts and Disbursements from "Oil Protection Fund" (Chapter 718, Statutes 1915), for the Department of Petroleum and Gas, for the Period of July 1, 1916, to June 30, 1917.

RECEIPTS.

Balance for sixty-eighth fiscal year	$561 36	
Receipts from assessments for Oil Protection Fund	140,537 57	
Refund of auto license fees paid state	43 50	
Total		$141,142 43

DISBURSEMENTS.

Reimbursement of General Fund for appropriation		$20,000 00	
Expenditure for support of Department of Petroleum and Gas from balance from sixty-eighth fiscal year		84 74	
Office of headquarters:			
Salaries	$14,481 84		
Equipment	3,066 40		
Traveling expenses	1,199 16		
General expense	2,343 18		
Printing	829 63		
Total		21,920 26	
Los Angeles Office:			
Salaries	$5,502 27		
Equipment	1,177 00		
General expense	1,691 32		
Total		8,370 59	
Coalinga Office:			
Salaries	$4,904 55		
Equipment	1,408 45		
General expense	1,559 39		
Total		7,872 39	
Taft Office:			
Salaries	$8,399 65		
Equipment	1,221 00		
General expense	3,364 07		
Total		12,984 72	
Santa Maria Office:			
Salaries	$2,400 00		
Equipment	909 25		
General expense	1,245 43		
Total		4,554 68	
Unexpended balance		65,355 05	
		$141,142 43	$141,142 43

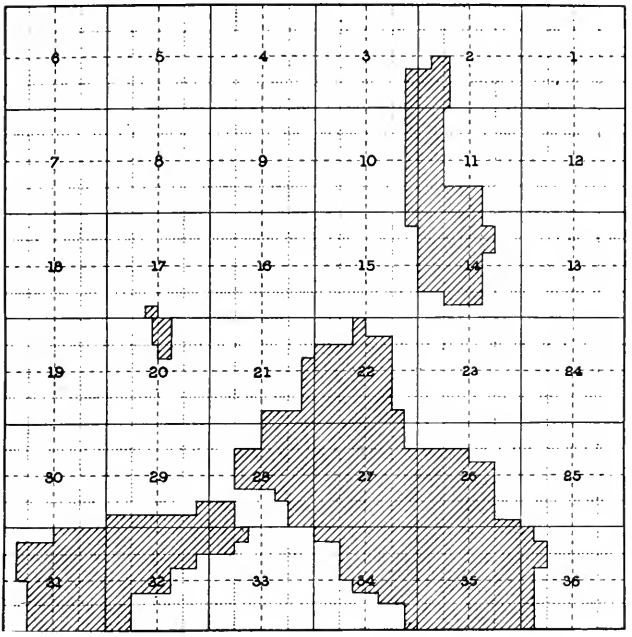
The above statement represents the total receipts of and disbursements from the Oil Protection Fund.

W. W. THAYER, Secretary

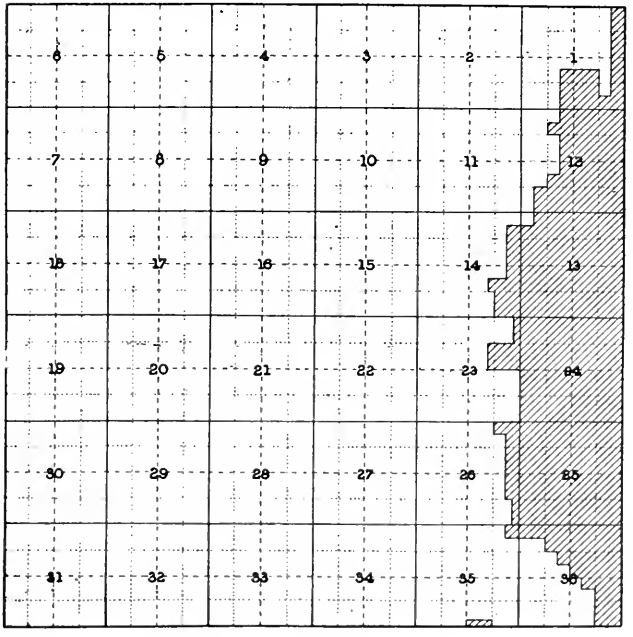
PROVED OIL LAND ASSESSED.

March —, 1917.

T. 19 S., R. 15 E., M. D. M. — Fresno County.



T. 20 S., R. 14 E., M. D. M. — Fresno County.



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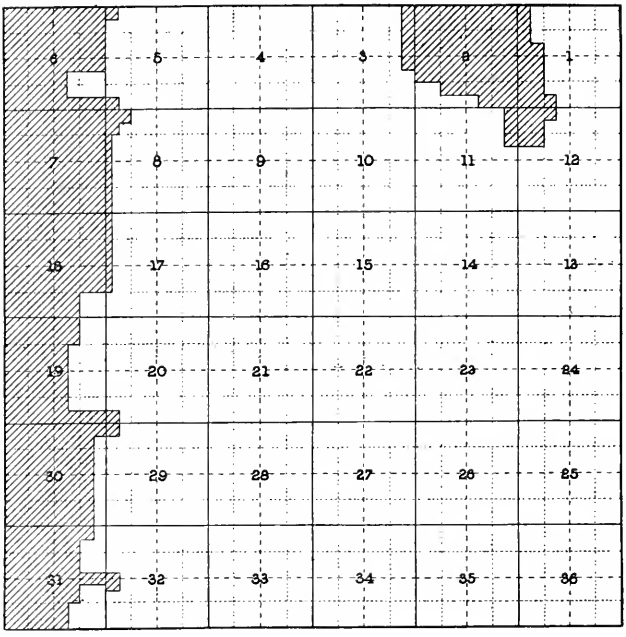

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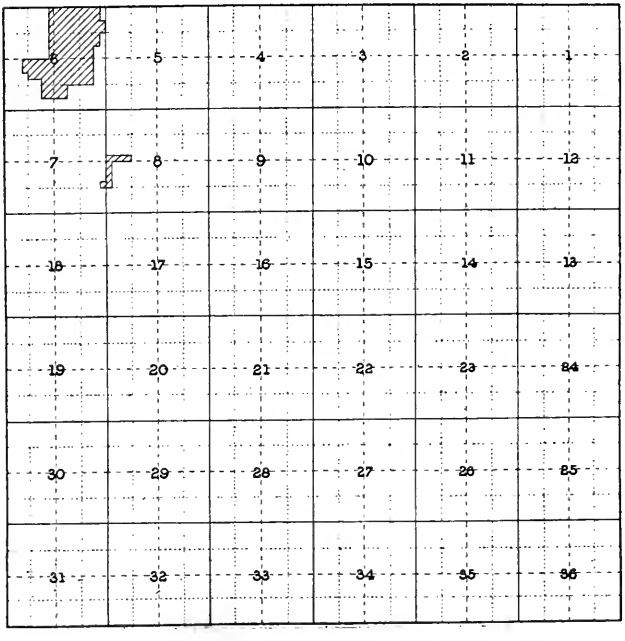
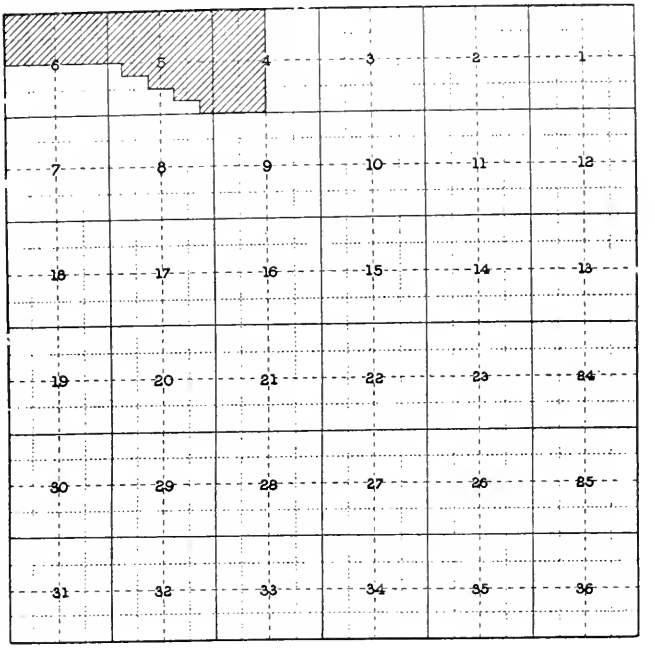


T. 11N., R. 23W., S.B. M. — KERN COUNTY.



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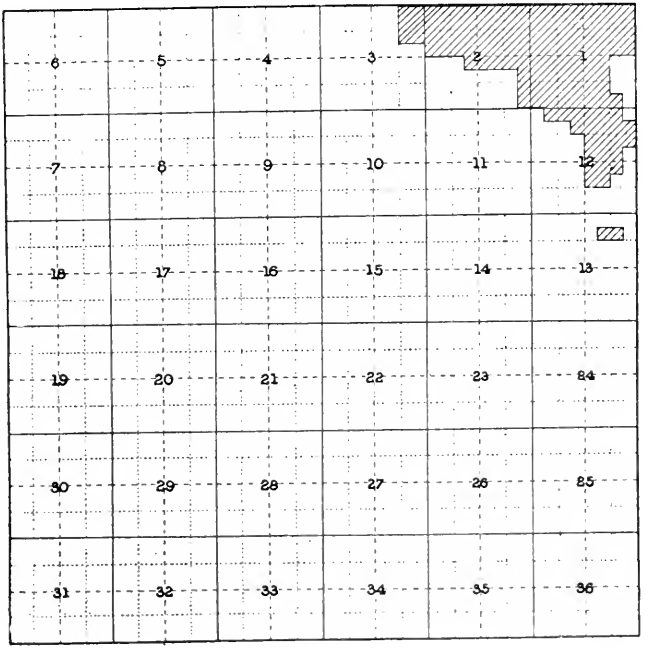

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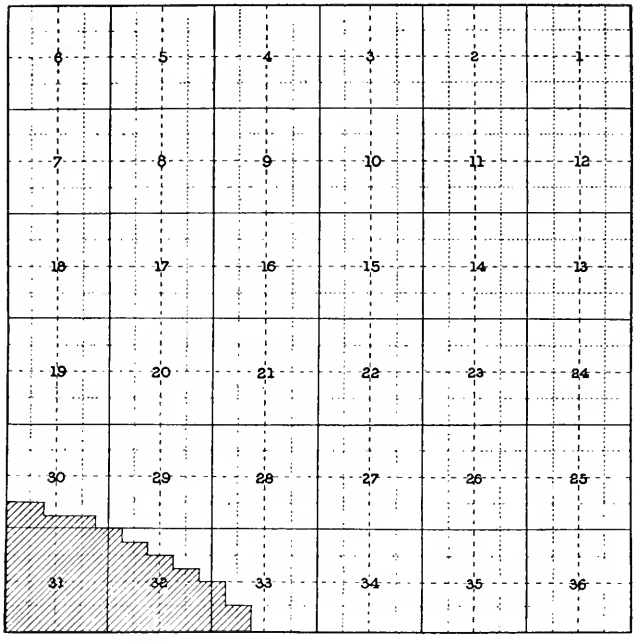

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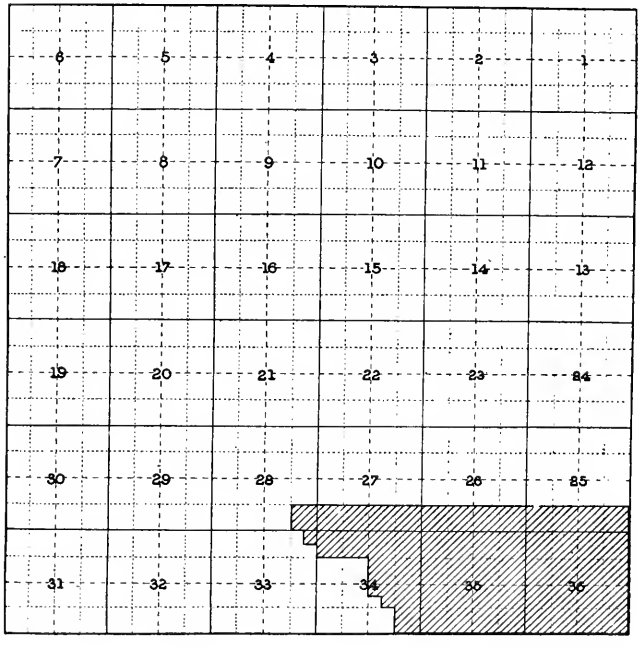
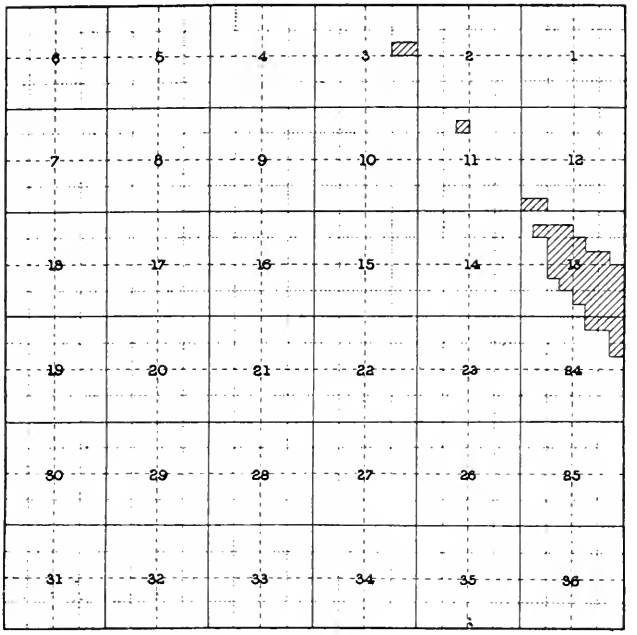
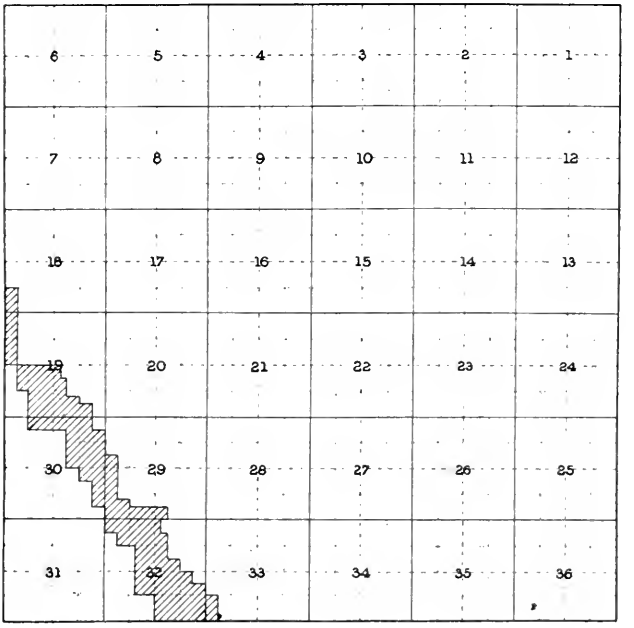


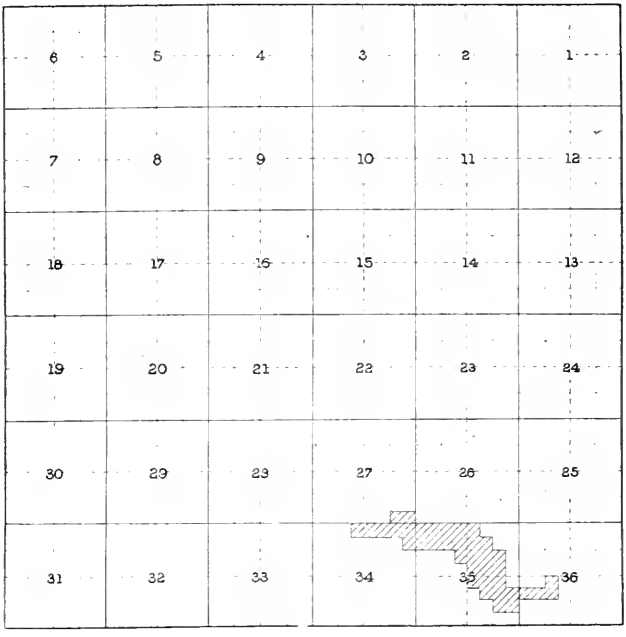
T. 26 S., R. 20 E., M. D. M. — Kern County.



T. 26 S., R. 21 E., M. D. M. — Kern County.



T 27 S., R. 20 E., M.D.M. — KERN COUNTY.



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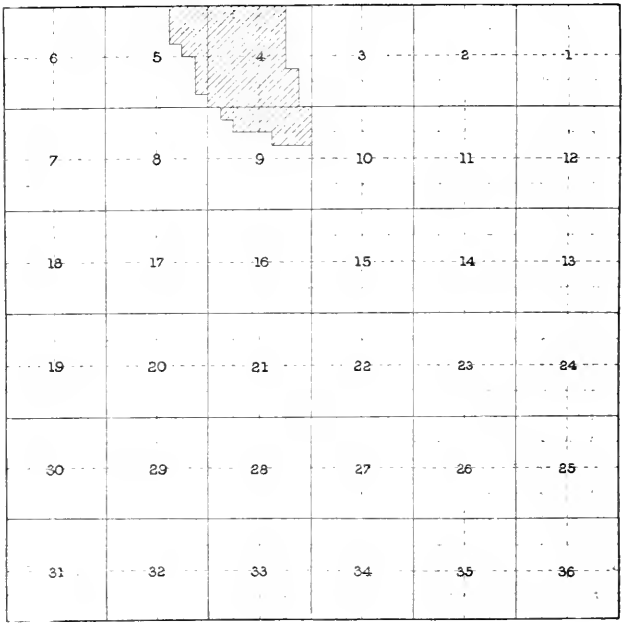
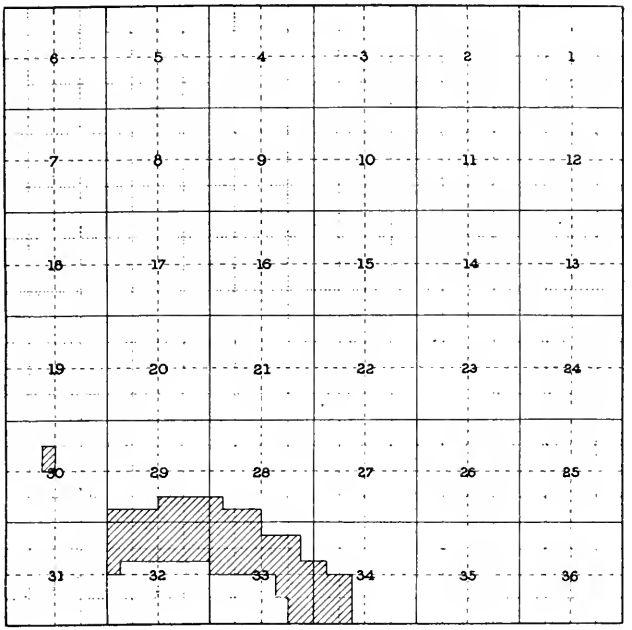


T. 28 S., R. 21 E., M. D. M. — KERN COUNTY.



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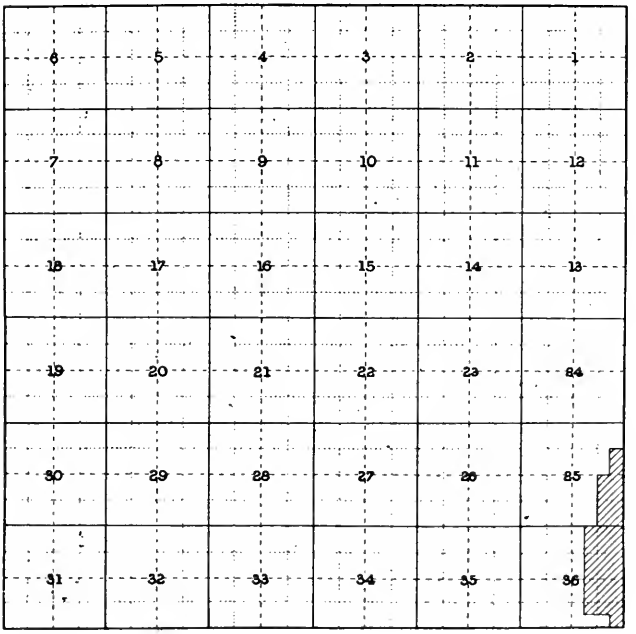

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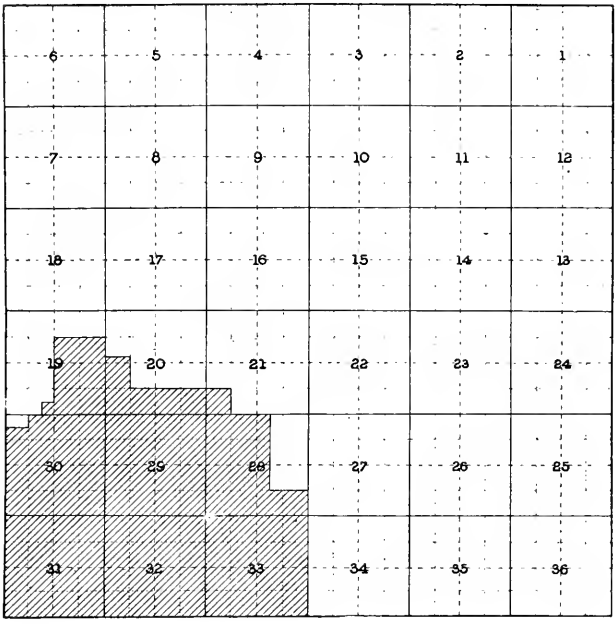

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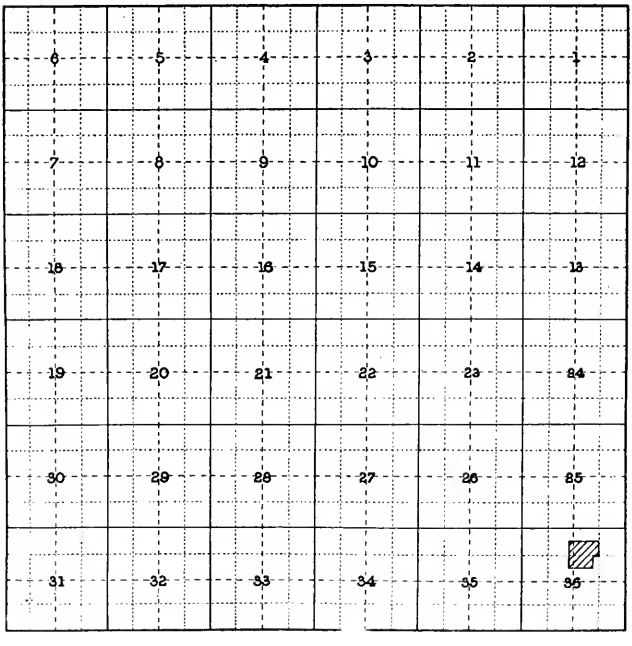

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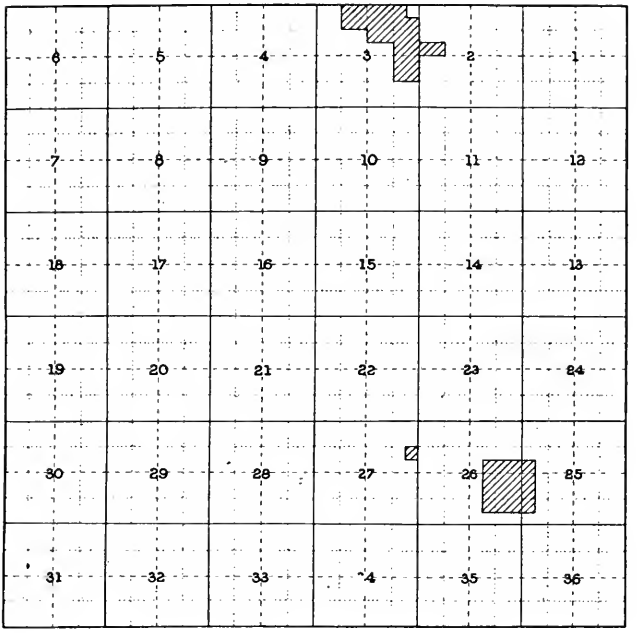

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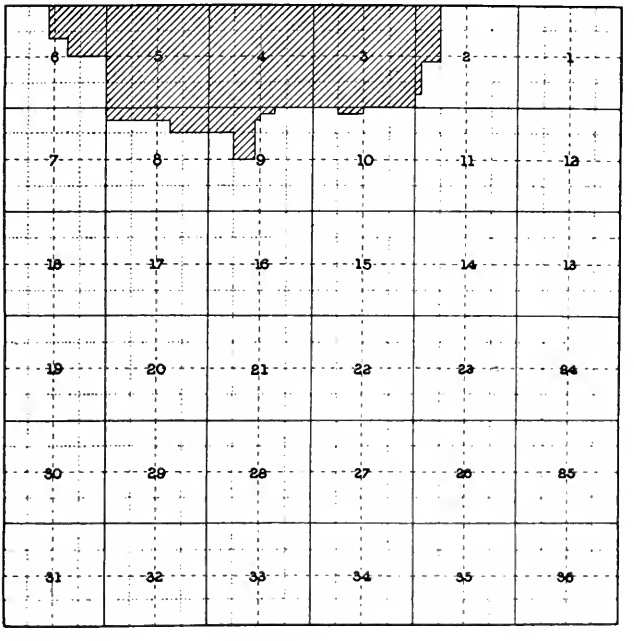

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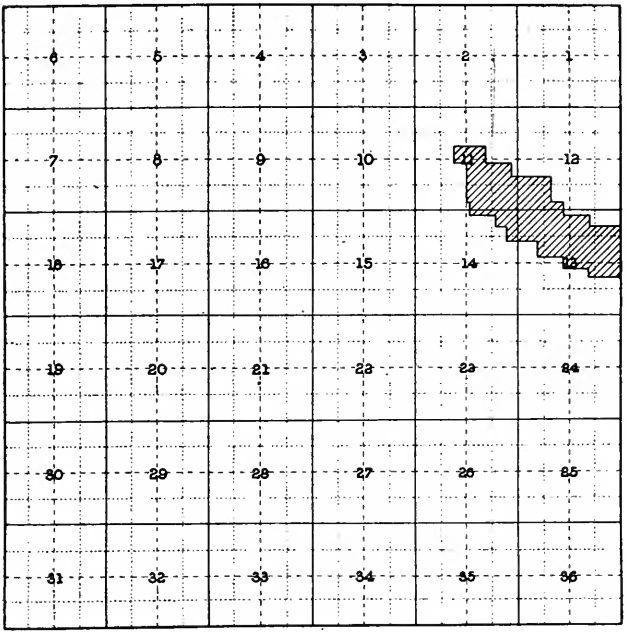

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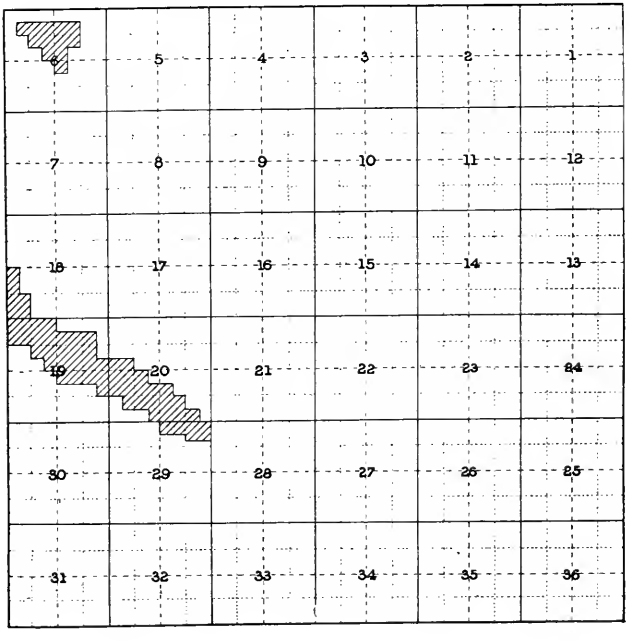

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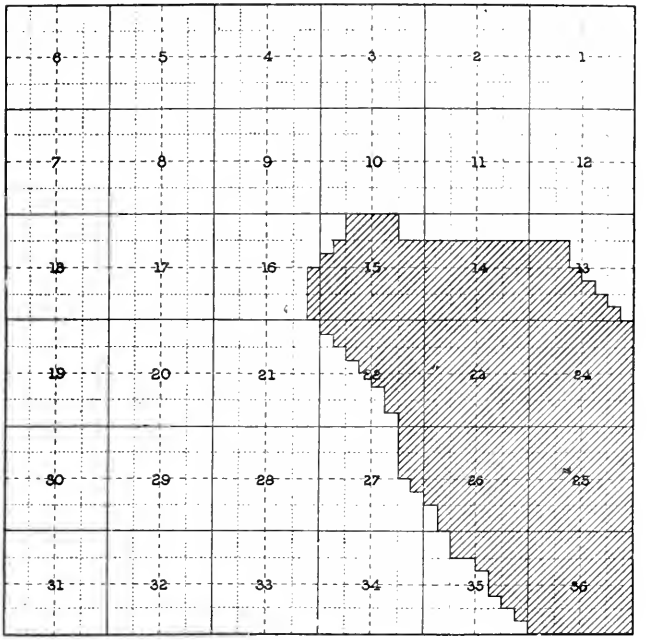

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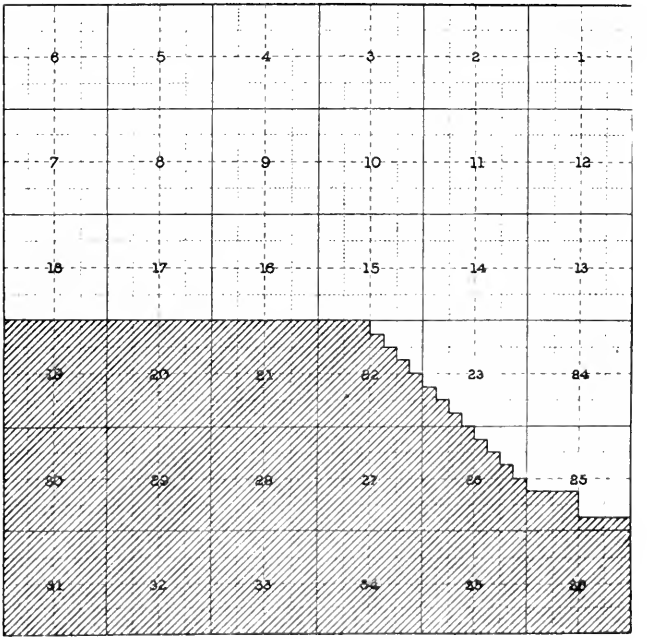
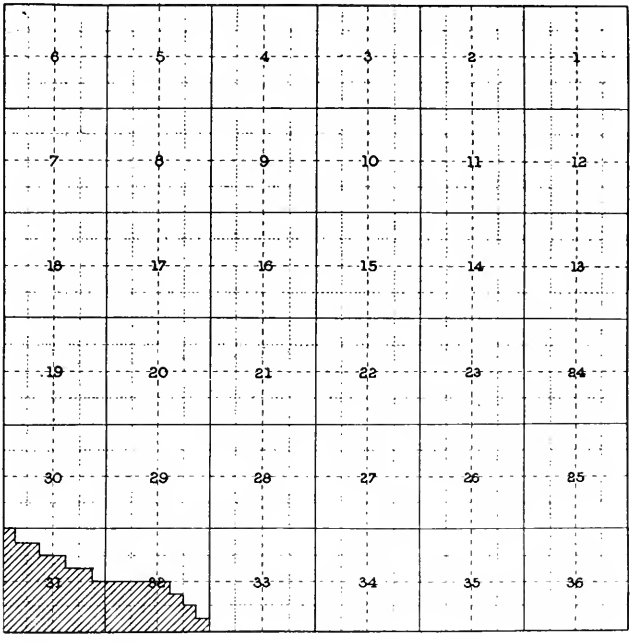
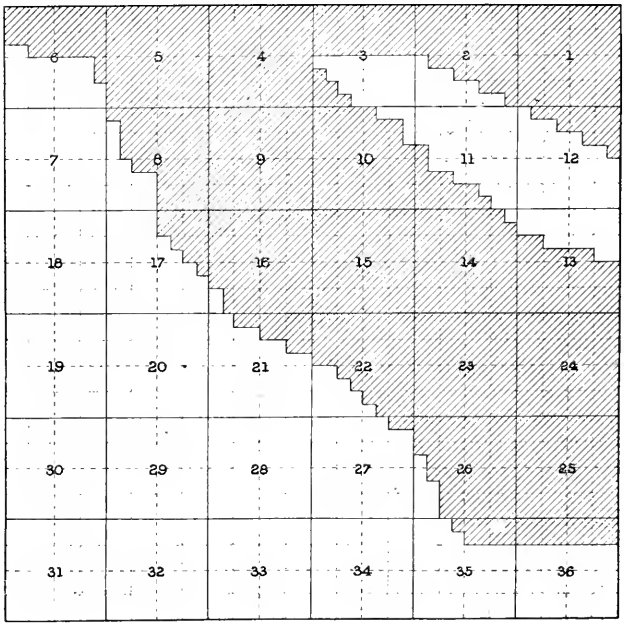


T. 31 S., R. 24 E., M. D. M. — KERN COUNTY.



T. 32 S., R. 23 E., M. D. M. — KERN COUNTY.



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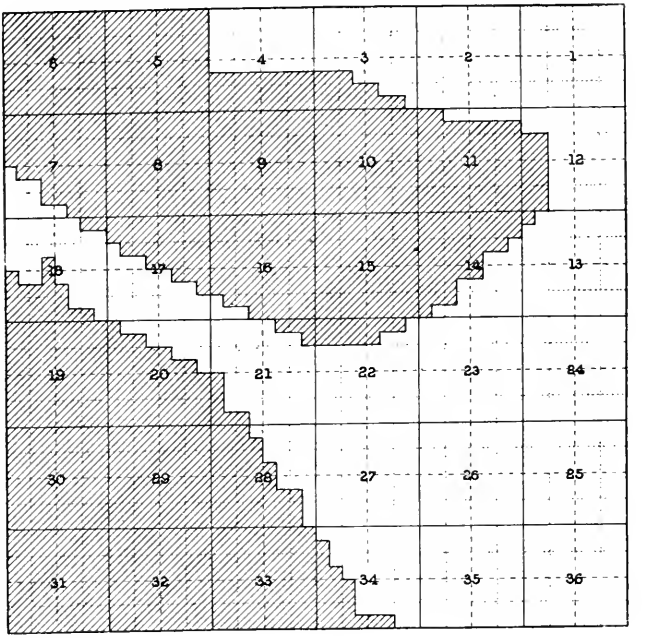
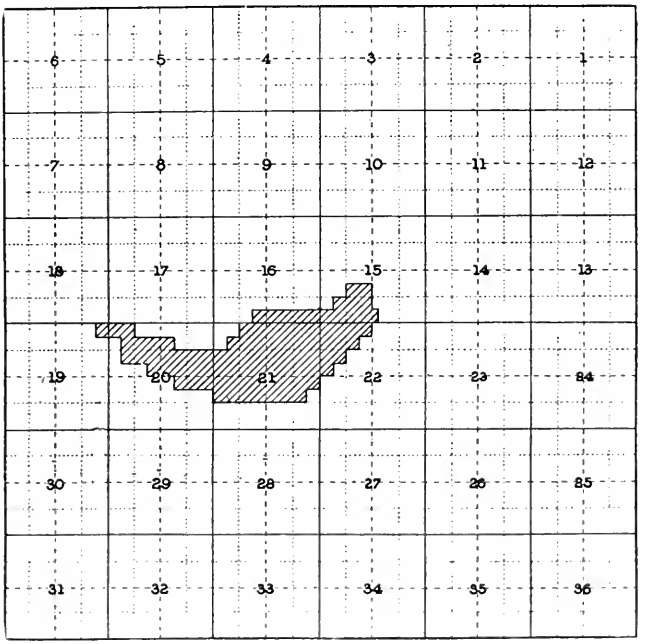
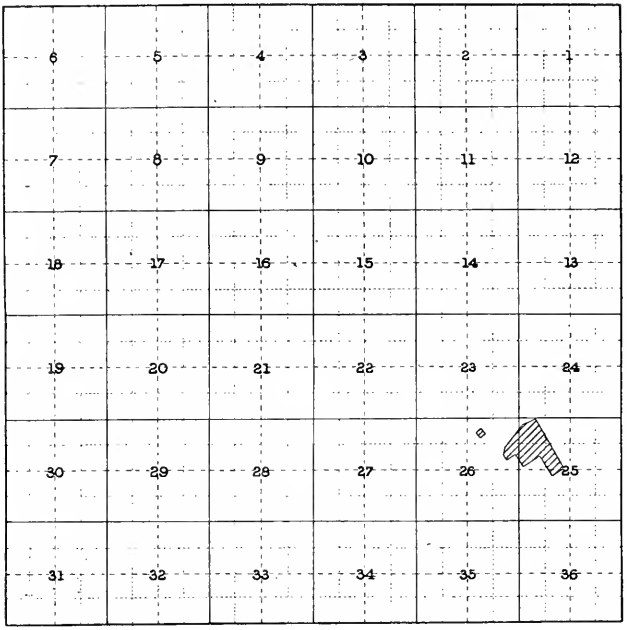


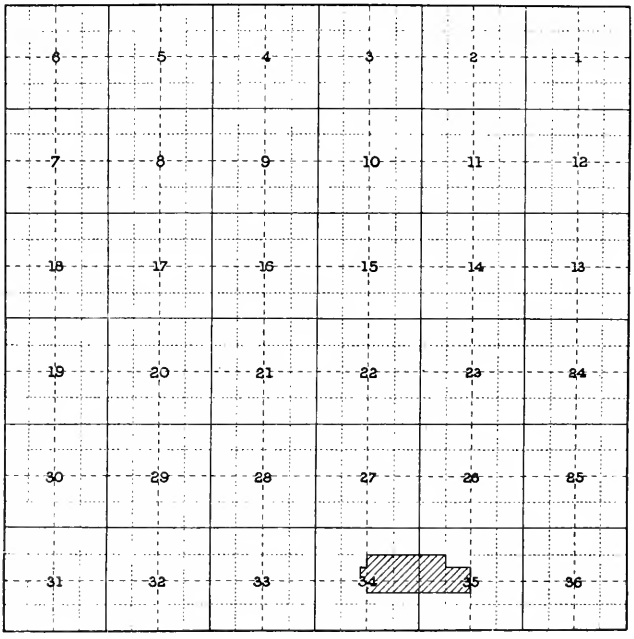
T. 1 S., R. 14 W., S. B. M. — LOS ANGELES COUNTY.



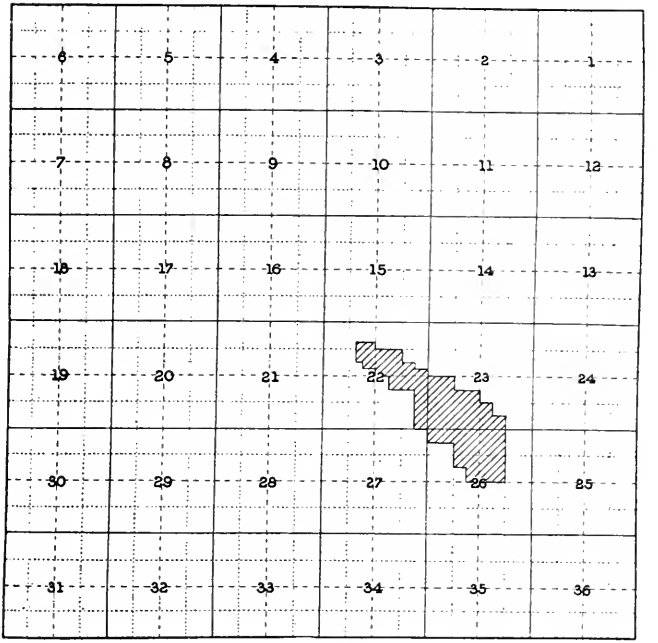
T. 1 S., R. 15 W., S. B. M. — Los Angeles County.



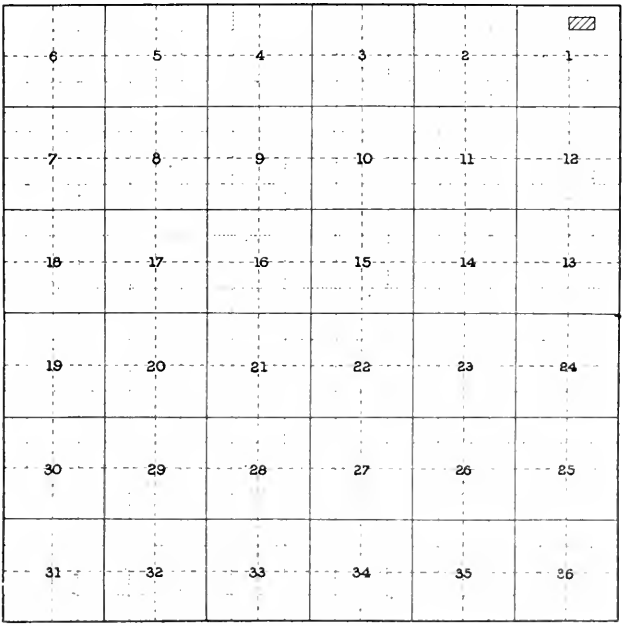
T. 2 S., R. 10 W., S. B. M. — Los Angeles County.



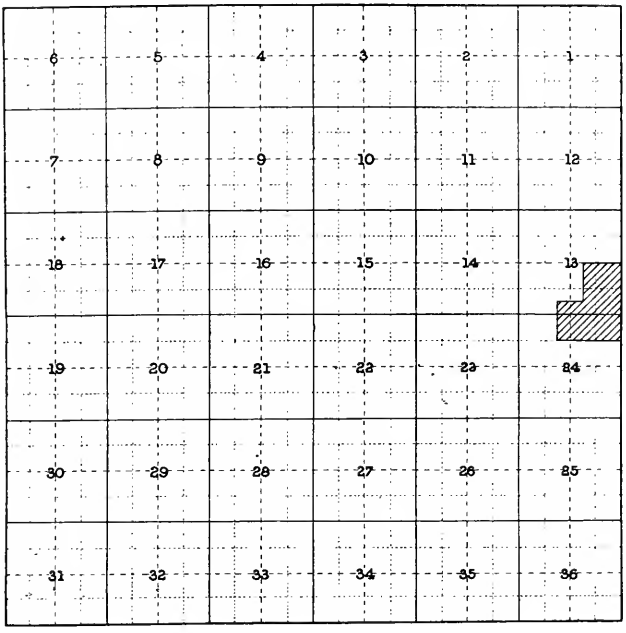
T. 2 S., R. 11 W., S.B. M. — Los Angeles County.



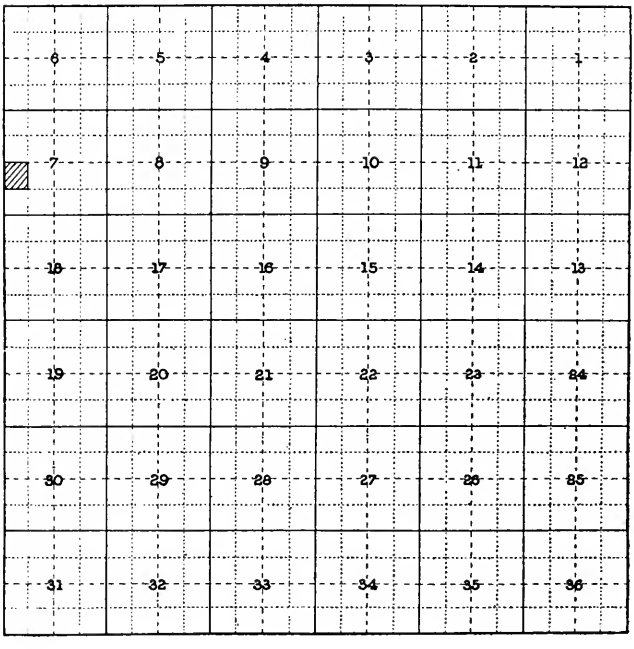
T. 2 S., R. 12 W., S.B. M. — Los Angeles County.



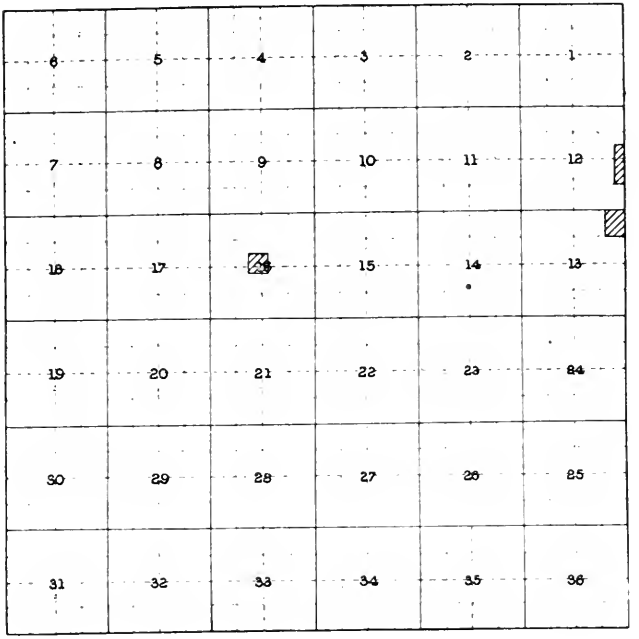
T. 3 S., R. 11 W., S.B. M. — Los Angeles County.



T. 3 N., R. 15 W., S.B. M. — Los Angeles County.



T. 3 N., R. 16 W., S.B.M. — Los Angeles County.



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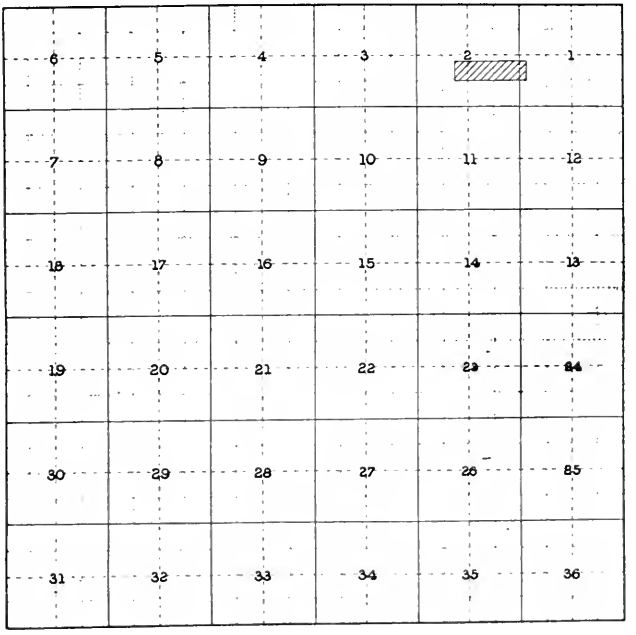
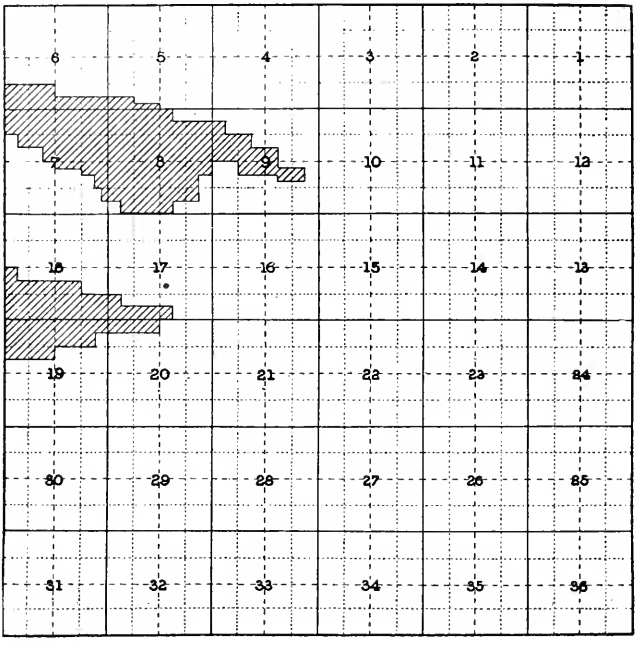
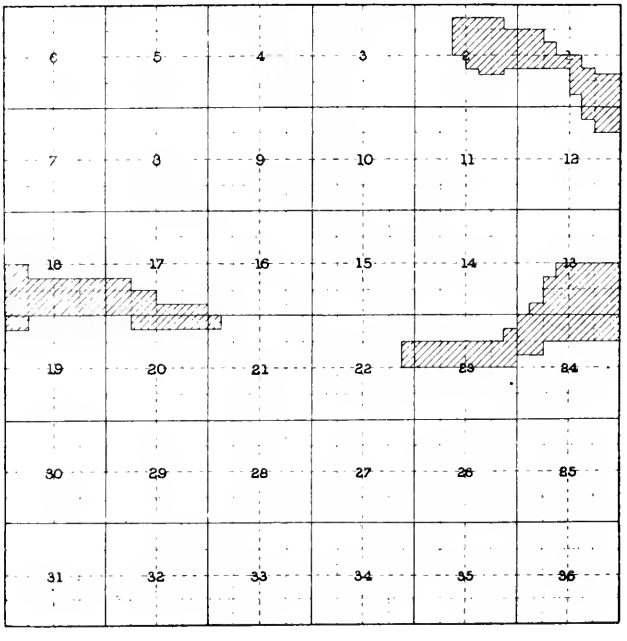


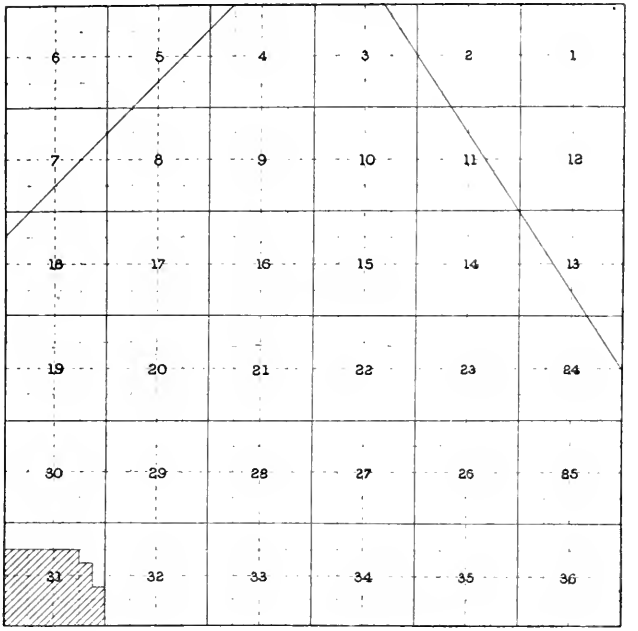
T. 3 S., R. 9W., S.B.M. — ORANGE COUNTY.



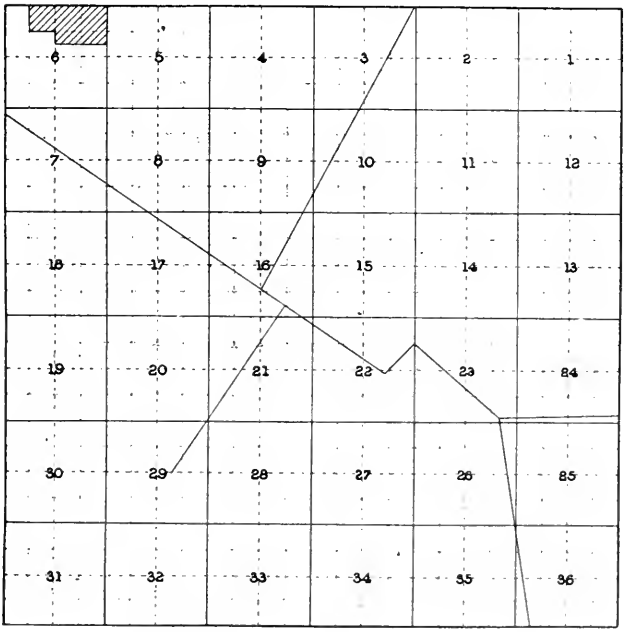
T. 3 S., R. 10W., S.B.M. — ORANGE COUNTY.



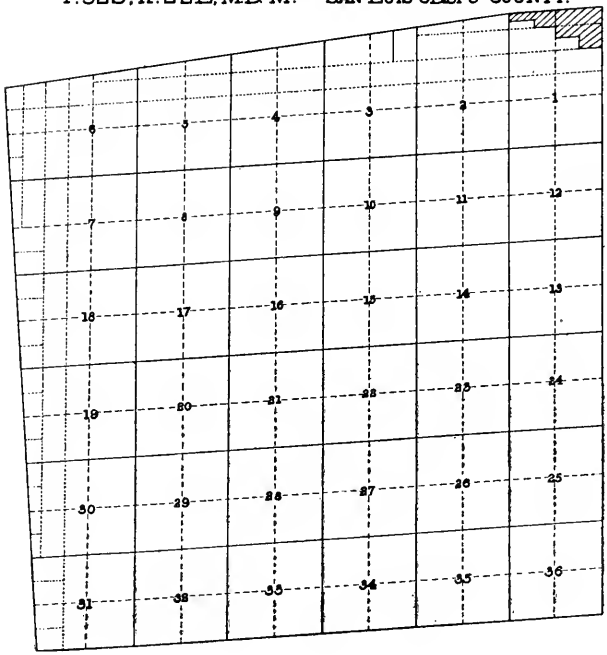
T. 31S., R. 13E., M. D. M. — SAN LUIS OBISPO COUNTY



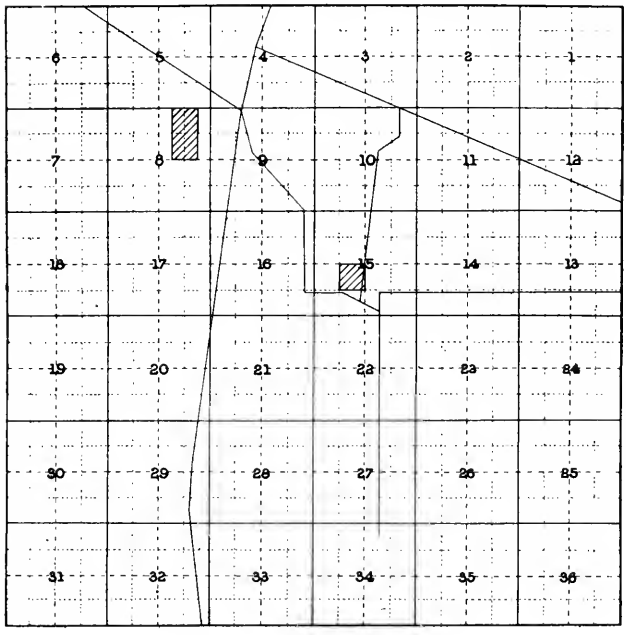
T. 32S., R. 13E., M. D. M. — SAN LUIS OBISPO COUNTY.



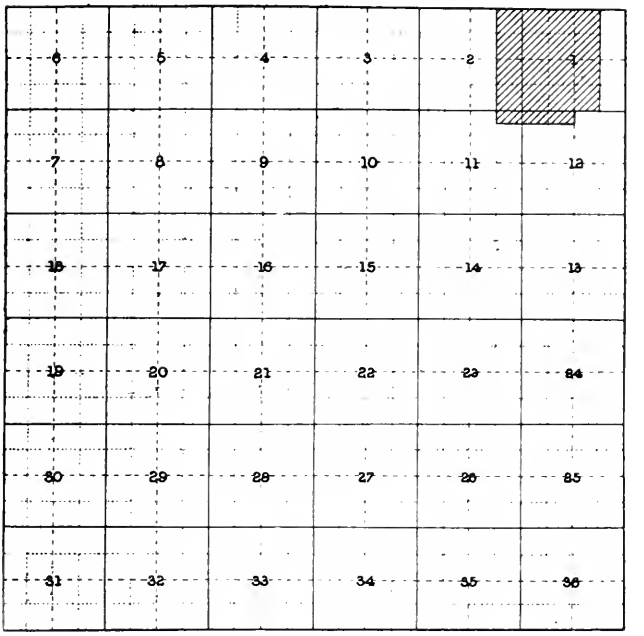
T. 32S., R. 22E., M.D. M. SAN LUIS OBISPO COUNTY.



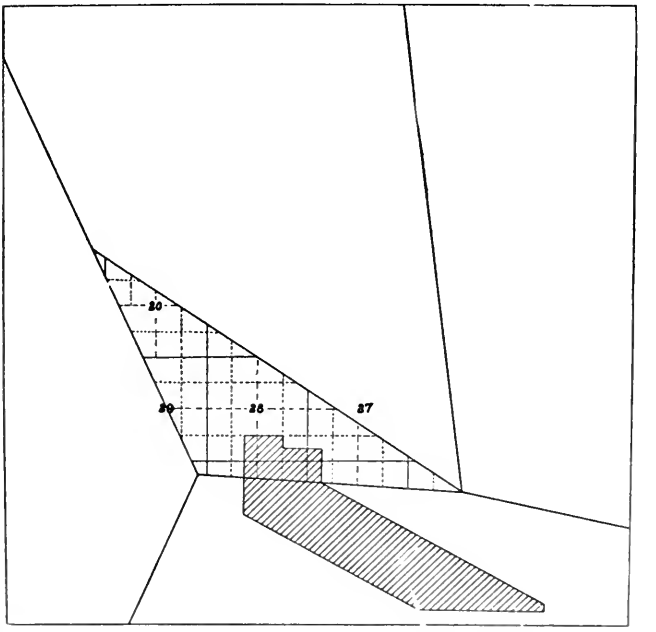
T. 8N., R. 32W., S.B. M. —SANTA BARBARA COUNTY.



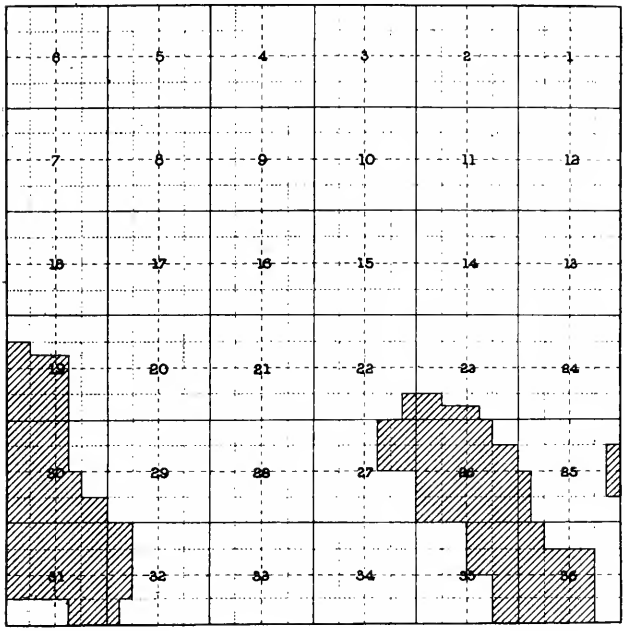
T. 6 N., R. 33 W., S. B. M. — SANTA BARBARA COUNTY.



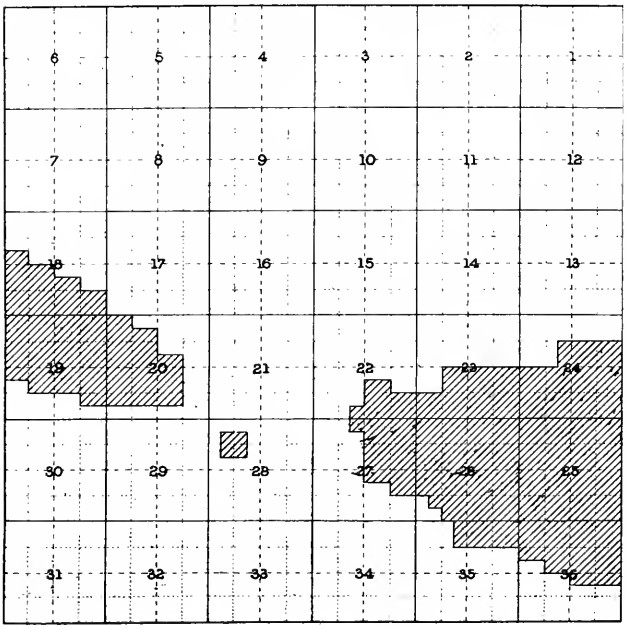
T. 8 N., R. 34 W., S. B. M. — SANTA BARBARA COUNTY.



T. 9 N., R. 33 W., S. B. M. — SANTA BARBARA COUNTY.



T. 9 N., R. 34 W., S. B. M. — SANTA BARBARA COUNTY.



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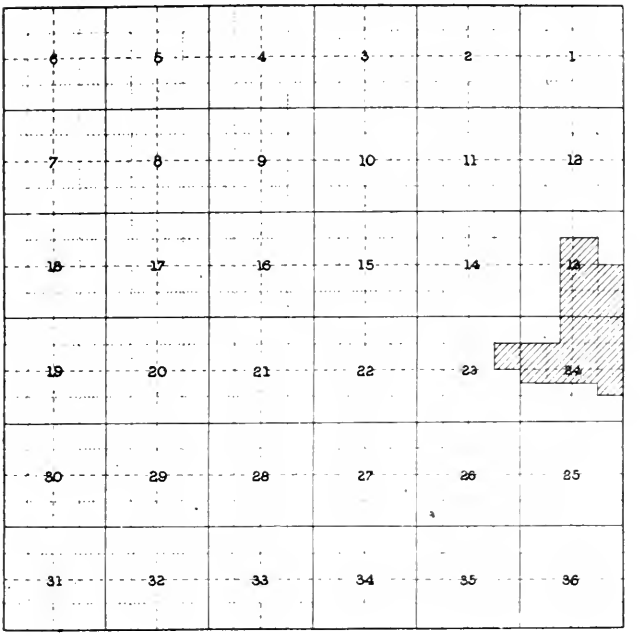
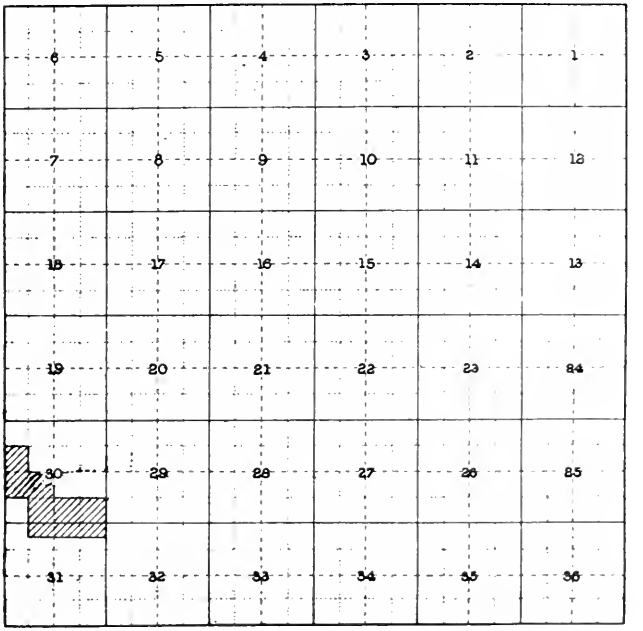
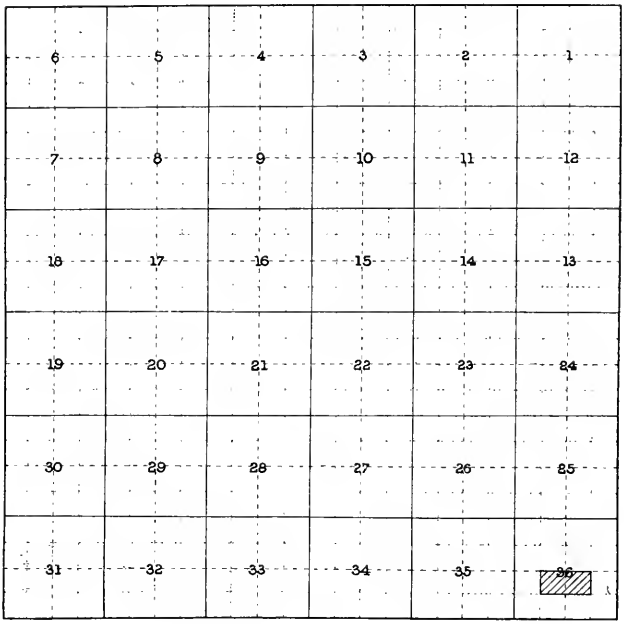


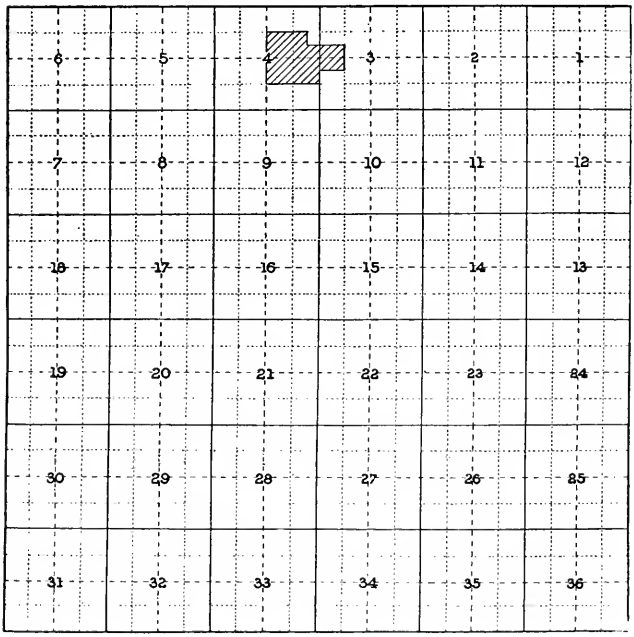
T. 9N., R 32W., S.B. M. —SANTA BARBARA COUNTY.



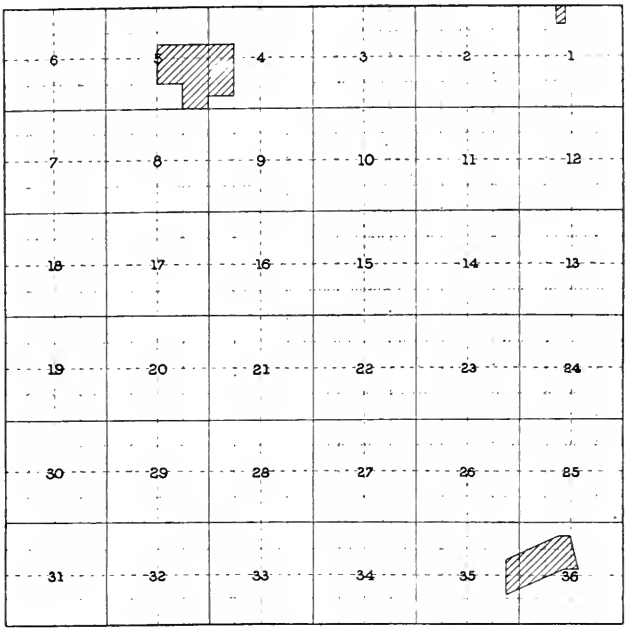
T. 11 S., R. 3 E., M. D. M. — SANTA CLARA COUNTY.



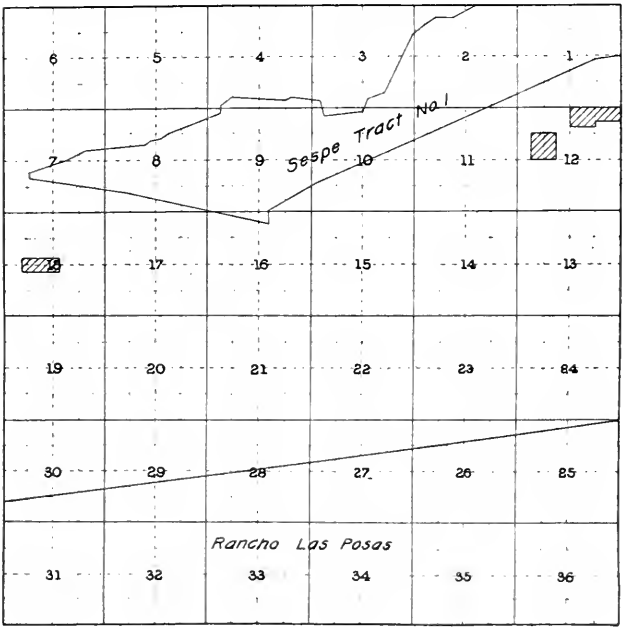
T. 3 N., R. 19 W., S. B. M. — VENTURA COUNTY.



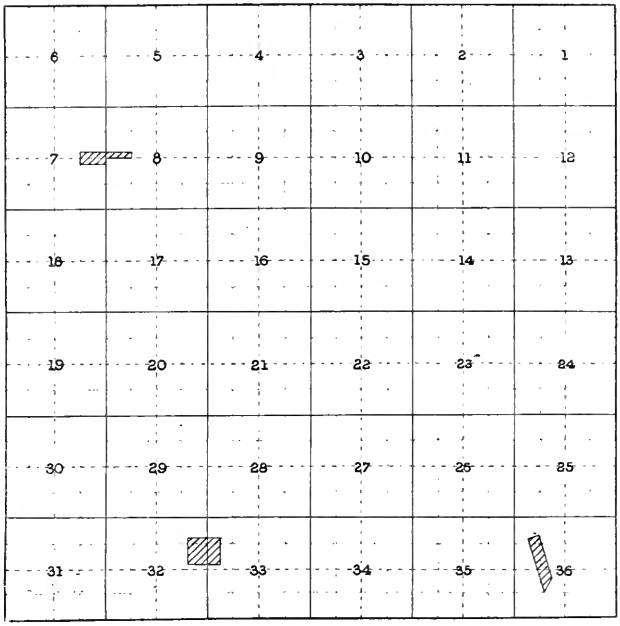
T. 3 N., R. 18 W., S. B. M. — VENTURA COUNTY.



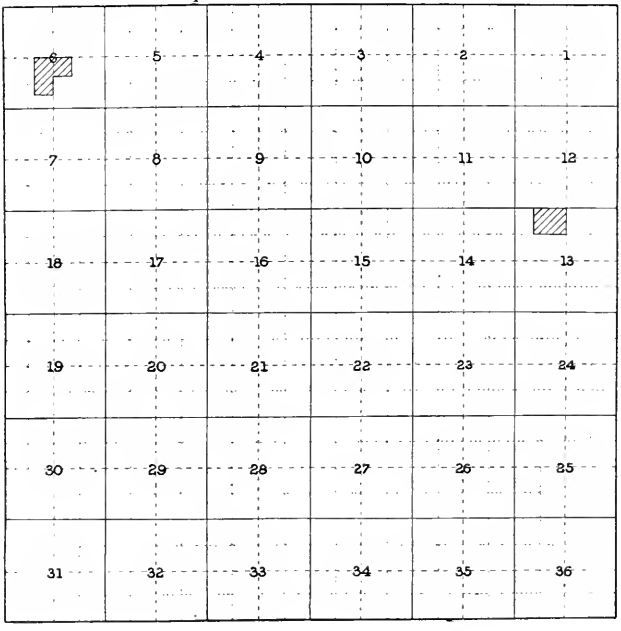
T. 3 N., R. 20 W. S. B. M. — VENTURA COUNTY.



T. 4 N., R. 18 W., S.B. M. — Ventura County.



T. 4 N., R. 19 W., S.B. M. — Ventura County.



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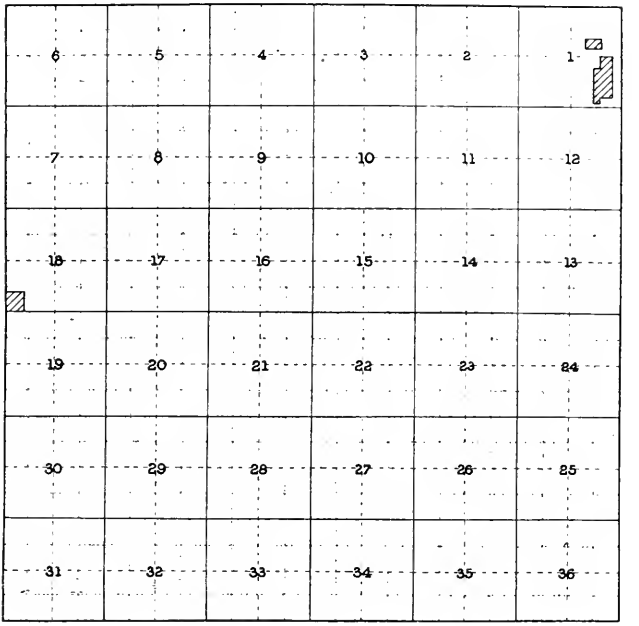

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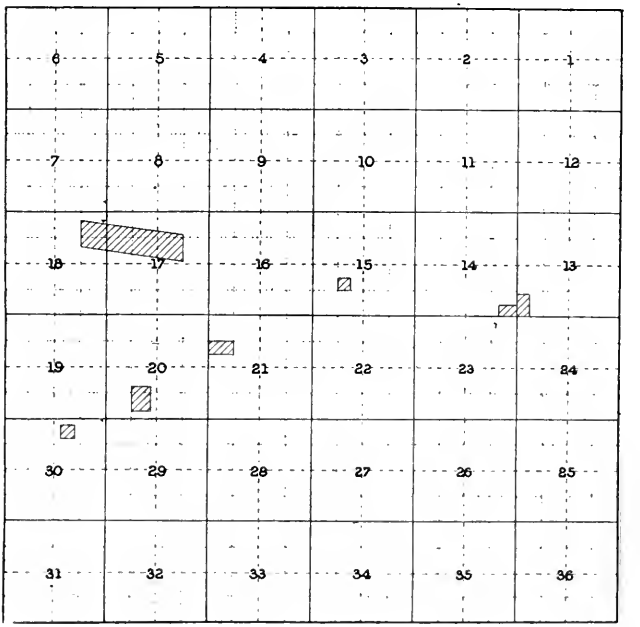
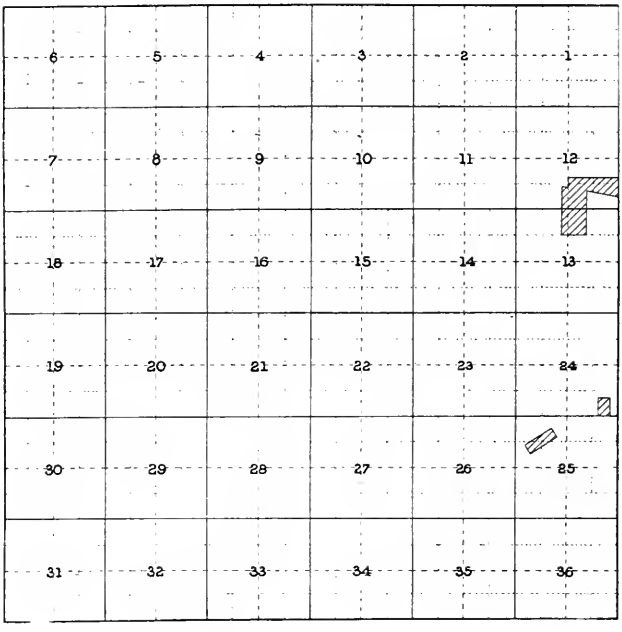
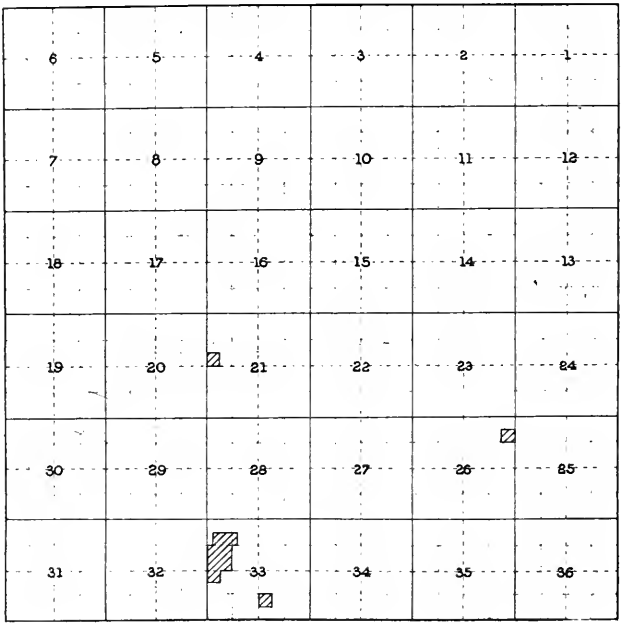


T. 4 N., R. 22 W., S. B. M. — VENTURA COUNTY.



T. 5 N., R. 19 W., S. B. M. — VENTURA COUNTY.



WORK OF DEPUTIES IN VARIOUS FIELDS.

The work carried on at our various local offices is shown by the following tabulation:

Deputy, office address and counties covered	Notices and decisions				Acres proved land	Number producing wells	Logs filed	Graphic logs	Models, acres
	New wells	Shut-off	Deepen and redrill	Abandon					
M. J. Kirwan, 520 Union League Bldg., Los Angeles, Cal.—Los Angeles, Orange and Ventura counties	90	96	38	33	6,994	1,321	1,159	858	1,680
R. E. Collom, Santa Maria, Cal.—Santa Barbara, San Luis Obispo and Santa Clara counties	98	88	39	21	10,630	362	393	246	2,250
R. N. Ferguson, Taft, Cal.—Kern County	638	629	360	99	56,122	4,246	4,406	1,098	6,500
R. D. Bush, Coalinga, Cal.—Fresno County	114	155	245	47	12,703	944	1,265	297	2,570
	940	938	682	200	86,479	6,873	7,223	2,499	13,000

Additions to the technical staff have made it possible to make considerable advance in solving the problems before us. The work is, however, far from completed. The percentage of completion is to some extent indicated by comparison of the number of graphic logs with the number of producing wells. Another indication is furnished by comparison of figures for proved acreage and models.

Attention is again called to the fact that operators must give considerable attention to the technical details of their own operations, and can not expect this department to provide all plans for development and repair.

The reports by the various deputies have necessarily been so condensed as to omit much information of general interest, as it was impossible to carry on our regular work and at the same time write a complete and detailed statement of it. It is believed, however, that enough information is given so that interested readers will be given a clue for any further inquiries.

The supervisor has at all times had the active co-operation of all the deputies, without which it would be impossible to conduct the work of the department. The loss of two deputies during the past year was keenly felt. Mr. Chester Naramore left to accept the responsible position of Chief Petroleum Technologist of the U. S. Bureau of Mines. Mr. R. B. Moran resigned in order to again engage in the oil business as an operator.

CHAPTER II.

LOS ANGELES, ORANGE, AND VENTURA COUNTIES.

By M. J. Kirwan.

Territory.

The work assigned to this office included supervision of wells in districts Nos. 1 and 2, as prescribed in Section 10 of Chapter 718, as amended in 1917.

District No. 1 includes the counties of Los Angeles, Orange, Riverside, San Diego, Imperial and San Bernardino.

District No. 2 consists of the county of Ventura.

Organization.

The position of Deputy Supervisor was filled by Mr. Robert B. Moran, until March 15, 1917, when his resignation took effect. The present deputy assumed charge on this date, having been transferred from the Coalinga office of the department. The deputy was assisted in the work by a stenographer, whose time was divided between this department and the department of mining, and two inspectors.

GENERAL STATEMENT.

The work of this department for the fiscal year ending June 30, 1917, resulted in more detailed supervision of drilling and maintenance of oil wells than the year previous, on account of the additional assistants provided the deputy and more complete file of well records.

The following written notices were received during the past year: New wells, 128; Deepen or redrill, 40; Abandonment, 46. During this time 226 written decisions were made relative to various operations at wells. Included in this number were 129 decisions concerning operations in drilling new wells. The depth at which water should be shut off in new wells was given particular attention and recommendations covering this important feature of the work were made for each new well where there was sufficient available information. Various peg models were constructed and a number of cross sections made to aid in solving the underground problems presented to the department. The staff of assistants has been recently enlarged and the scope of this work greatly broadened.

The tables given under Districts Nos. 1 and 2 show that decisions were made for 157 tests of water shut off. A representative of the department witnessed practically every one of these tests. In some cases the tests did not prove satisfactory and recommendations were made for further tests or additional shut-offs. In most cases, the proposals to deepen or redrill received the approval of the department.

The attention of certain operators was called to the necessity of shooting sidetracked casing to prevent its acting as a conductor of water into wells redrilled to shut off water.

Detailed recommendations were made for every well abandoned, in which the depths of shooting and plugging were given.

A total of 877 graphic logs have been drawn, or 61.4% of all logs received in Districts Nos. 1 and 2. Nearly all of these logs were drawn in the San Francisco office of the department. Graphic logs are still being drawn as rapidly as possible. Prints of graphic logs were sent to operators who did not have engineering or geological departments, when decisions were made relative to abandonment work and important redrilling jobs. Cross sections were given to a number of operators to assist them in a study of underground conditions.

The data relative to production of various fields, used in compiling tables which are listed under Districts Nos. 1 and 2, was taken from monthly production reports received from various operators.

Monthly production reports are being received from all producing companies, except one, in District No. 1. Production reports have not been received regularly from all producing companies in District No. 2. In many cases the reports are of an unsatisfactory nature. In a few cases operators furnished the department with reports showing the amount and percentage of water in the oil produced by each well, after all free water had been drained off. It is obvious that such reports are of little value. Some companies make no serious effort to determine the amount of oil or water produced by individual wells for their own information, or for this department.

Plans have been made to have a representative of the department visit each producing property and discuss with the Superintendent or Manager the best and most economical means of obtaining production figures for individual wells. In some cases an estimate of the amount of oil produced and a sample of fluid from the lead line, properly tested, will give sufficient information relative to the amount of water produced. The production of certain wells do not justify the expense of providing tanks to measure the fluid production.

The following table and diagram are given to illustrate a use of production data made by this department in studying water conditions at a group of twenty-nine wells.

TABLE A.

Production Records Taken From Monthly Production Report for June, 1917:

Well No.	Barrels of clean oil	Barrels of water	Percentage of water	Number of days produced	Remarks
3	4	96	96	29	
6	28	96	77	30	
7	96	38	28	27	
9	3	0	0	1	
11	13	8	38	20	
12	2	5	71	3	
13	18	0	0	20	
14	96	46	32	30	
15	58	329	85	29	
20	181	27	12	30	
21	28	32	53	30	
22	136	174	56	30	
23	26	45	63	23	
24	130	115	47	30	
25	160	180	53	30	
26	51	290	85	27	
27	138	148	52	30	
28	65	0	0	29	
29	289	0	0	30	
30	52	25	32	30	
32	265	0	0	30	
33	68	6	8	26	
34	113	0	0	29	
35	44	2	4	28	
36	184	0	0	30	
38					Drilling
39					Drilling
40					Drilling
42					Drilling

Maps were prepared similar to that herewith shown, using symbols showing the comparative amount of water produced daily, during the month of June for each well in Districts Nos. 1 and 2. The wells shown in triangles were colored yellow, wells shown in squares colored blue and wells shown in circles colored red in order to give prominence to the different well classifications as determined by amounts of water which they produce.

A summary, showing the number and kind of notices received and decisions rendered, together with a brief statement relative to each decision, is given by section, township and range for each company, following the discussion for each field.

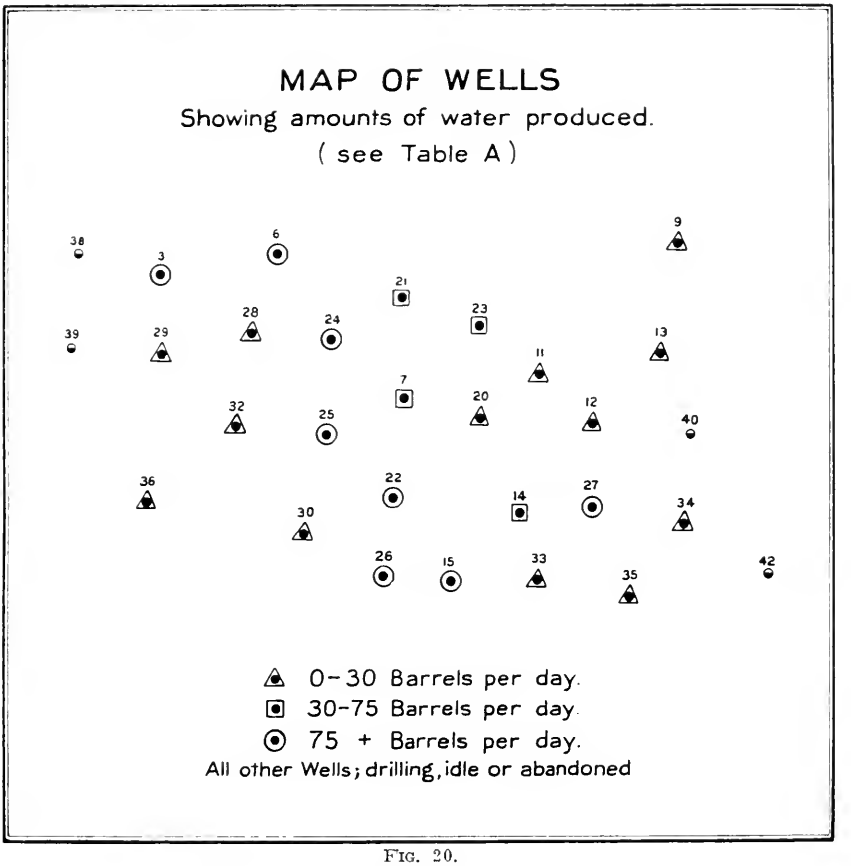


FIG. 20.

MAPS.

Thanks are due to the following individuals and companies for furnishing general field maps and maps of their properties showing well locations and other useful information.

Security Oil & Dev. Co.
County of Los Angeles Road Dept.
Pacific Light & Power Corp.
Riverside Portland Cement Co.
Petroleum Development Co.
Clara Baldwin Stocker.
General Petroleum Corporation.
San Diego Cons. Oil Co.
Union Oil Co.
Eureka Cañon Syndicate.
Rancho La Brea Oil Co.
Salt Lake Oil Co.
West Coast Oil Co.
Olinda Land Co.
Amalgamated Oil Co.
Red Star Petroleum Co.
Standard Oil Co.
Montebello Oil Co.
Central Oil Co. of Los Angeles.
Columbia Oil Producing Co.
Brea Canyon Oil Co.
R. B. Moran.
The Petrol Co.
Beatty Oil & Dev. Co.
Calumet Oil Co.
Oak Ridge Oil Co.
W. E. Barry.
Associated Oil Co.
Shell Co. of California.
Baird Oil & Asphalt Co.
White Star Oil Co.
Southern California Edison Co.

The Amalagamated Oil Company furnished this department with a copy of a geological report and oil contour map covering the property of this company in the Coyote Hills field.

LIST OF COMPLAINTS.

There were only two complaints received during the past year which required a detailed investigation by this office. A summary of work done on these complaints follows:

ANAHEIM UNION WATER COMPANY vs. AMALGAMATED OIL COMPANY.

During the latter part of the year 1916, the attention of this department was directed by the Anaheim Union Water Company to the serious water condition of Amalgamated Oil Company wells along the south line of the Anaheim lease, in Section 13, T. 3 S., R. 10 W., S. B. B. & M., Coyote Hills field.

The matter of this complaint was called to the attention of the Amalgamated Oil Company by this department, and request made for more complete log and history records and record of individual well production as far back as available. The company responded promptly and furnished production reports and very complete records of work done at various wells. Shortly after the receipt of this information, this department completed a number of cross sections, water and production curves, covering wells in the affected area.

Wells on the property of the Petroleum Company, adjoining, were entirely free from water until November, 1916, when Well No. 1 showed a small amount of free water and some emulsion. The water condition of this well gradually grew worse until the company proposed to shut off the top oil sand in hopes of improving the water condition of this well.

Extensive tests made by the company under the supervision of this department demonstrated that water from above the top oil sand was not entering the well. After these tests had been concluded approval was given to shut off the top oil sand. At the present time the well stands cemented.

A number of conferences were held at the Los Angeles office of the State Mining Bureau and attended by representatives of all parties concerned in the water condition on the Anaheim lease and adjoining properties. Considerable repair work has been carried on at various wells as shown by the list of decisions.

The source of the water trouble affecting certain wells in the area mentioned has not been determined. The detail structure of the eastern portion of this field has not been completely and satisfactorily

worked out. Preparations have been made by this department to complete the peg model which has been constructed covering about one half of the Coyote Hills field. When this has been done, the source of water affecting certain wells on the Anaheim lease and adjoining properties, should be better known and further recommendations will be made by this department covering tests at wells, or repair work so far as conditions warrant.

BREA CANON OIL COMPANY vs. BIRCH OIL COMPANY.

During the early part of 1917 the attention of this department was directed by the Brea Cañon Oil Company to the increase in water in their wells along the west line of their property in Section 2, T. 3 S., R. 10 W., S. B. B. & M. The Brea Cañon Oil Company expressed the opinion that this increase in water resulted from the water condition of Birch Oil Company wells, adjoining on the west.

An investigation by this department showed that water conditions in a number of wells in the western part of the Brea Cañon field were serious, and that some of the affected wells in this area probably produce large amounts of water from formations penetrated near the bottom of these wells.

Tables showing the production of Brea Cañon Oil Company wells along the western side of their property were made and showed that there was a slight increase in the amount of water produced by Well No. 27. During February, 1917, this well averaged 23 barrels of water per day, which was the largest amount of water produced per day by any wells of the Brea Cañon Oil Company, located on the western side of their property. Well No. 10 of the Birch Oil Company was completed and commenced pumping March 6, 1917, after which date the water content of fluid produced by Brea Cañon Well No. 27 decreased until in June it averaged less than 5 barrels of water per day. It appears that drilling water from Birch Well No. 10 probably entered Brea Cañon Well No. 27. The water condition of the latter well is now considered satisfactory by the Brea Cañon Oil Company.

LEGAL ACTION TAKEN BY THE DEPARTMENT.

The Providential Oil Company, operating in Section 19, T. 3 S., R. 9 W., S. B. B. & M., Coyote Hills field, failed to file log records and monthly production reports of their producing wells and notices relative to two wells which were drilling. A number of requests were made for these records and various blanks providing space for information required sent to officials of the company. After waiting for over a year, a formal demand for records and notices was made upon the company,

but they failed to reply or file any records. Finally it became necessary for the State Oil and Gas Supervisor to take action against the company for their failure to comply with the law.

On May 10, 1917, the deputy supervisor swore to a criminal complaint and, after summons had been served upon the company, they immediately filed the required records with this department.

After the records had been filed, a request was made by this department to the Prosecuting Attorney of the city of Los Angeles to dismiss the complaint. This was done, because it has been the aim of this department to act in an advisory rather than a prosecuting capacity.

The management of the Providential Oil Company recently changed hands and the new officials are actively co-operating with this office in the matter of protecting the oil bearing formations on this property from water.

DISTRICT No. 1.

The entire production of oil in this district was obtained from Los Angeles and Orange counties.

The name Whittier-Fullerton oil fields follows common usage to include all the fields east of the city of Los Angeles; namely, Olinda, Brea Cañon, Whittier, Coyote Hills, Montebello and Puente.

The number of wells in this district, number of producing wells, number of logs filed, number of graphic logs, average daily production of oil and water, percentage of water, number of acres of proved oil land, is shown by fields in the following tabulation:

TABLE 1.

Field	Wells listed	Logs filed	Graphic logs	Number of wells accounted for by production reports	Number of wells actually producing, according to production reports	Average daily production		Average daily production per producing well		Percentage of water
						Barrels oil	Barrels water	Barrels oil	Barrels water	
Coyote Hills	221	215	204	171	161	26,285	2,631	163	16	9.1
Olinda	348	224	206	266	251	7,598	926	30	3.7	10.8
Brea Canyon	89	72	67	66	62	4,717	2,032	76	33	30.1
Puente	85	3	0	44	44	62	4	1.4	0.1	6.0
Whittier	244	211	193	150	139	3,222	2,624	23	19	44.9
Montebello	3	3	3	2	2	852	0	426	0	0.0
Salt Lake	417	394	185	272	243	3,436	2,186	14	9	38.8
Newhall	209	32	0	76	75	362	325	5	4	47.3
Miscellaneous	5	5	0	0						
Totals	1,612	1,159	858	1,047	977	46,534	10,728	47.6	11	18.8

The following table gives a summary of written notices received and decisions made in this district during the past year:

District No. 1—Field	New wells		Test of water shut off		Deepen or redrill		Abandon	
	Notices	Decisions	Notices	Decisions	Notices	Decisions	Notices	Decisions
Coyote Hills	36	38	59	48	17	19	18	17
Olinda	18	18	12	18	2	2	1	1
Brea Canyon	2	2	3	2	2	3	------	------
Whittier	9	8	17	13	8	8	1	1
Montebello	11	9	2	2	------	------	------	------
Salt Lake	4	1	2	1	4	3	4	4
Newhall	4	4	9	10	------	------	4	4
Miscellaneous	6	6	4	2	2	3	5	6
Totals	90	86	108	96	35	38	33	33

COYOTE HILLS FIELD.

In the recent classification of oil field names, the fields sometimes referred to as East Coyote and West Coyote, are now called Coyote Hills field by the State Mining Bureau.

GEOLOGY.

In general the surface contour of the Coyote Hills indicates the geological structure of these hills. The structure of both hills is anticlinal.

Study of peg model constructed of the western range of hills, including Sections 17, 18, 19, 20, and the western portions of Sections 16 and 21, T. 3 S., R. 10 W., and Sections 13 and 24, T. 3 S., R. 11 W., indicates that the underground structure conforms to a marked degree with the surface structure. The geology of this portion of the Coyote Hills as described in Bulletins Nos. 63, 69 and 73 of the State Mining Bureau, in which the underground structure of the field was forecast from evidences of surface outcrops, has been borne out by study of the well records, detailed cross sections and a complete peg model, constructed by this department during the past year.

A contour of the top of the producing oil zone, as shown by the peg model, is a dome with an elongated axis in an approximate east and west direction, the apex of the dome being in the S. W. $\frac{1}{4}$ of Section 18, T. 3 S., R. 10 W. The anticline plunges gradually east and west from this point, and the dip of the flanks appears to be greater than the plunge of the axis.

Recent wells completed and producing near the apex of the fold and on the south flank of the anticline (in the N. $\frac{1}{2}$ of Sec. 19, T. 3 S., R. 10 W.) are prolific producers. The depth to which these wells

have been drilled into the oil bearing formations, and the proximity to the apex of the dome probably accounts for the large production of these wells.

Only a small part of the eastern portion of the Coyote Hills field has been covered by a peg model made by this department.

Surface geology of this portion of the field has been described in detail in publications of the State Mining Bureau, mentioned above, and in various reports made by geologists in the employ of private companies operating in this field.

A difference of opinion still exists as to the correct correlation of the oil horizons. The completion of the peg model which is under construction by this department no doubt will aid in solving this problem. The logs of seven wells located in the eastern part of Sec. 23, T. 3 S., R. 10 W., and along the west line of Sec. 24, T. 3 S., R. 10 W., show an upper oil zone. This zone is worth protecting from water as a number of these wells produce a considerable quantity of oil. One of these wells was recently completed and produces at the rate of about 600 bbls. of oil per day from this zone only. The production of other wells in this area comes from a second zone, which probably is the main source of production in the eastern portion of the Coyote Hills.

SUMMARY OF WATER CONDITIONS.

Study of monthly production reports for June, and map prepared showing relative amounts of water produced by individual wells, shows that 161 wells produced during this month. Of this number, 134 wells produced from 0 to 20 barrels of water per day, making a total of 19,651 barrels of water, or an average of 5 barrels per day. Ten wells produced from 20 to 40 barrels of water per day each, making a total of 8,657 barrels, or an average daily production of 29 barrels of water. Seventeen wells produced a total of 50,623 barrels, or an average of 99.3 barrels of water per day each. The foregoing record of production shows that the water conditions are not very serious.

Most of the wells producing more than 40 barrels of water per day are on the edge of producing territory. There is a difference of opinion as to whether or not the majority of these wells produce "edge water," or water that has not been properly shut off. Nine of the wells producing more than 40 barrels of water each per day, are located in the southern half of Section 13 and the northern half of Section 24, T. 3 S., R. 10 W. The remaining wells are distributed throughout the field along the edge of the producing territory. One well in this field averaged over 11,000 barrels per month, and steps have been taken by the owner to shut off water in this well. Several

wells producing large amounts of water will probably be repaired or abandoned during the coming year.

There are comparatively few wells shut down on account of their water condition. It has been the general policy of operators in this field to abandon and plug wells which produce large quantities of water after determining that it would not be profitable to attempt to shut off the water in order to make them produce clean oil.

A number of wells have been recently abandoned in the southeastern part of the field on account of small production of oil. Many of the wells in this area produce an emulsion from which it is difficult to separate the oil. The fluid levels in nearly all of these wells stand low enough to indicate that water above the oil sands is shut off and that the water produced comes through the oil bearing formation from an undetermined source.

FUTURE DEVELOPMENTS.

The limits of the productive area from present producing zones of this field have been fairly well defined. There has been considerable development work in the western portion of the field and no doubt the present proved area will be extended by future wells drilled.

The abandonment of a number of wells in the southeastern part of the field on account of small production of oil indicates that it would not be profitable to drill new wells in this area, to produce from formations penetrated by present wells. A deep test well in the eastern part of this field may possibly show that productive formations underlie the present producing zones.

Following is a summary of all decisions rendered and notices received by the department during the past year. This tabulation

gives a list of various companies and the sections in which active development or repair work was carried out.

Section	Township	Range	Company	New wells		Test of water shut off		Deepen or redrill		Abandon	
				Notices	Decisions	Notices	Decisions	Notices	Decisions	Notices	Decisions
17	3 S	9 W	St. Hel. Pet.							1	1
17	3 S	9 W	Quintuple Oil			1	1				
17	3 S	9 W	Union Oil			1	1				
18	3 S	9 W	Union Oil	4	4	3	3			3	3
18	3 S	9 W	St. Hel. Pet.					2	2		
18	3 S	9 W	Standard							1	1
19	3 S	9 W	Fetterman					2	2	1	1
19	3 S	9 W	Standard							1	1
19	3 S	9 W	S. D. Consol.					2	1		
19	3 S	9 W	Calokla							2	3
19	3 S	9 W	Prov. Oil		2	1	1				
19	3 S	9 W	Fullerton Gr. West					1	1		
20	3 S	9 W	Standard			2				1	1
20	3 S	9 W	Quintuple							1	1
24	3 S	9 W	Yorba Oil							1	
29	3 S	9 W	Union	1	1						
8	3 S	10 W	Tri-State		2						
13	3 S	10 W	Amalgamated	1	1	2	2	4	5		
13	3 S	10 W	Union			1	1				
17	3 S	10 W	Standard	1	1	2	2				
18	3 S	10 W	Standard	5	3	6	6	1	1		
19	3 S	10 W	Standard	4	4	2	2				
22	3 S	10 W	Union		1						2
22	3 S	10 W	Standard	1	1		1			2	2
23	3 S	10 W	Union Oil	5	6	11	12	1	1	2	
23	3 S	10 W	Amalgamated	3	3	5	5	1	2		
24	3 S	10 W	Amalgamated	2	1	1	1				
24	3 S	10 W	The Petroleum			3			1		
28	3 S	10 W	Union Oil	1	1						
4	3 S	11 W	Union Oil	1	1						
13	3 S	11 W	Standard	2	2	5	4	3	3	1	1
24	3 S	11 W	Standard	5	4	13	6			1	
			Totals	36	38	59	48	17	19	18	17

Following is a list of decisions rendered covering operations at wells in this field for the past year, accompanied by a brief description showing character of work done at each well included in the list and recommendations made by this department.

DECISIONS.

T. 3 S., R. 9 W., S. B. B. & M.

SECTION 17.

St. Helens Petroleum Co., Ltd.

Well No. 1, abandon. CC-299.

Plan of proposed abandonment as submitted by company was approved as satisfactory.

Quintuple Oil Co.

Well No. 2, shut-off. C-70.

Test showed that water was satisfactorily shut off.

Union Oil Co.

Well No. 2, Berkenstock, shut-off. C-185.

The results of test showed that a small amount of water entered the well while standing for test. Approval to resume drilling was given, contingent upon a production test after completion.

SECTION 18.

Union Oil Co.

Well G. & L. No. 12, abandon. CC-312.

Water string collapsed about 430′ above shut-off point.

Approved proposal to plug with cement about 50′ below point of collapse. Recommended that company leave sufficient casing in well to act as a conductor to a depth of about 2450′ in order that the well might be re-entered in case future developments indicate the necessity of further plugging.

Well G. & L. No. 29, abandon. CC-142.

Approved proposal to abandon, recommending shooting instead of ripping, in order to plug with cement at depths indicated in abandonment proposal.

Well G. & L. No. 35, abandon. CC-141.

Proposed method of plugging and abandoning approved.

Well G. & L. No. 36, shut-off. C-55.

On account of the well making considerable gas when first completed, it was impossible to make a bailing test, and a production test was taken thirty days after completion. The test showed well making 165 bbls. per day, of which 3% was water.

Well G. & L. No. 39, begin drilling. CC-118.

Approved proposed estimate of depth of water shut off.

Well G. & L. No. 39, shut-off. C-107.

Test satisfactory.

Well G. & L. No. 40, begin drilling. CC-119.

Approved proposed estimate of water shut-off.

Well G. & L. No. 40, shut-off. C-79.

Test of water shut off approved.

Well G. & L. No. 41, begin drilling. CC-120.

Estimated depth of water shut off approved.

Well G. & L. No. 42, begin drilling. CC-297.

Estimated depth of water shut off approved.

St. Helens Petroleum Co., Ltd.

Well No. 2 (Johnson), redrill. CC-256.

Approved proposal to remove upper portion of oil string.

Well No. 3 (Johnson), redrill. CC-270.

Approved proposal to remove upper portion of oil string.

Standard Oil Co.

Well (Robertson) No. 6, abandon. CC-116.

The proposed method of abandonment was approved.

SECTION 19.

The Fetterman Oil Co.

Well No. 1, redrill. CC-285.

Approved proposal to remove upper portion of oil string.

Well No. 3, redrill. CC-292.

Approved proposal to remove upper portion of oil string.

Standard Oil Co.

Well No. 1, Lemke, abandon. CC-206.

Approved proposal to abandon indicating depths at which shooting and plugging should be done.

San Diego Consolidated Oil Co.

Well No. 4, redrill. CC-306.

Approved proposed method of redrilling to shut off water.

Calokla Oil Co.

Well No. 1, Lehmer, abandon. CC-255.

Recommended shooting and plugging with cement between certain depths and that company determine that each plug be set properly.

Well No. 2, Lehmer, abandon. CC-268.

Approved abandonment proposal indicating depths at which shooting and plugging should be done. Recommended that company determine that each cement plug set properly.

Providential Oil Co.

Well No. 4, commence drilling. CC-277.

Approved proposal of the company to shut off water at a depth of about 2900′. Drilling was commenced at this well on about January 1, 1916. The company filed notice of intention to commence drilling on May 14, 1917, after legal action had been taken by this department against the company for failure to file certain records.

Well No. 4, shut-off. C-172.

Test of water shut off approved.

Calokla Oil Co.

Well No. 2, Lehmer, abandon. CC-323.

Approved proposal to shoot 10″ casing at a depth of 1500′ instead of a depth of 2000′ as formerly proposed. Plugging of lower portions of well had been completed as recommended in decision CC-268.

Providential Oil Co.

Well No. 5, commence drilling. CC-276.

Estimated depth of water shut off approved.

The Fetterman Oil Co.

Well No. 2, abandon. CC-300.

Approved proposal to abandon. Recommended shooting and plugging with cement, between certain depths.

Fullerton Great West Oil Co.

Well No. 3, redrill. CC-309.

After making a peg model of the field, including this property, it was found that the water string in this well had been carried through the top oil zone and cemented about 500′ lower than it should have been cemented. The water string failed to shut off water and the well was finished through the lower oil zone without having the water shut off. The company proposed to redrill this well and make an effective shut off at the proper depth, plugging the bottom of the well before redrilling to protect oil formations from water. This proposal was approved by this department.

SECTION 20.

Standard Oil Co.

Well No. 2, Coyote, abandon. CC-205.

Proposed method of abandonment approved.

Quintuple Oil Co.

Well No. 3, abandon. CC-267.

Approved proposal to abandon. Recommended shooting and plugging between certain depths and that the company determine that each cement plug be set properly.

SECTION 29.

Union Oil Co.

Well No. 1, Chapman, commence drilling. CC-316.

Recommended that company cement each string of casing landed above oil-bearing formations which may be encountered on account of this being a "wild cat" well.

T. 3 S., R. 10 W., S. B. B. & M.

SECTION 8.

Tri-State Oil Co.

Well No. 1, continue drilling. CC-213.

Recommended that the company file additional information relative to results of tests of water shut off which the company made without notifying this department.

Well No. 1, continue drilling. CC-252.

The company filed affidavit that water was successfully shut off at a depth of 4243'. Further information received from the company showed that water was bailed to a depth of 1300' and raised 500' while standing 24 hours. This decision stated that shut-off attempted at 4243' was not effective in shutting off water, and the test was, therefore, unsatisfactory.

SECTION 13.

Amalgamated Oil Co.

Well No. 6, Anaheim, shut-off. C-76.

The well was redrilled, sidetracking lower portion of original water string which had collapsed. The results of the test showed that new water string shut off water although water might possibly enter oil sand through original hole, which had not been plugged.

Well No. 10, Anaheim, redrill. CC-262.

Recommended that the company defer the proposed work of testing water string and plugging bottom of well, awaiting results of work in plugging bottom of adjoining well.

Well No. 12, redrill. CC-271.

Approved proposal to plug bottom of well in order to shut off possible bottom water.

Well No. 14, Anaheim, redrill. CC-242.

Recommended that the company defer work of testing water string and plugging bottom of well pending conference which had been arranged between the company, the owners of the land and neighboring companies.

Well No. 14, Anaheim, redrill. CC-261.

At conference arranged by this department and attended by representative of the company, owner of the land and neighbors, it was decided that it would be advisable to delay proposed work pending results of work done in plugging bottom of adjoining well.

Well No. 28, Anaheim, redrill. CC-241.

Approved proposal to replug bottom of well.

Well No. 30, Anaheim, begin drilling. CC-155.

Approved proposed estimated depth of water shut off.

Well No. 30, Anaheim, shut-off. C-118.

Test of water shut off satisfactory.

Union Oil Co.

No. 38, G. & L., shut-off. C-69.

Test of water shut off approved.

SECTION 17.

Standard Oil Co.

Well No. 19, M-C, shut-off. C-65.

The first shut-off was made with 8¼" casing at 3415'. The well made about 7,000,000 feet of gas per day, when tested. This casing collapsed and water was subsequently shut off with 6¼" casing at a lower depth.

Well No. 23, M-C, shut-off. C-149.

Test of water shut off satisfactory.

Well No. 31, M-C, drill. CC-278.

Approved proposed depth of water shut-off.

SECTION 18.

Standard Oil Co.

Well No. 15, Murphy-Coyote, redrill. CC-295.

Approved proposal to plug oil string below shoe of water string; cut off and pull out oil string above top of plug; put perforated die nipple on bottom of new oil string in order to screw on to casing left in the well and pump cement through the die nipple in order to shut off the top water. At this date tests have not been made to show results of this interesting mechanical operation.

Well No. 21, Murphy-Coyote, shut-off. C-116.

Test of water shut off satisfactory.

Well No. 24, Murphy-Coyote, shut-off. C-80.

Test of water shut off satisfactory.

Well No. 25, shut-off. C-77.

Company made test of water shut off without notifying this department to witness same. The results of the test indicated that water was shut off.

Well No. 28, Murphy-Coyote, commence drilling. CC-223.

Approved proposed depth of water shut off.

Well No. 28, Murphy-Coyote, shut-off. C-165.

Test of water shut off satisfactory.

Well No. 29, Murphy-Coyote, drill. CC-182.

Approved proposed depth of water shut off.

Well No. 29, Murphy-Coyote, shut-off. C-180.

The results of the test indicated that 8¼" casing did not shut off water. Recommended that plug be put in below shoe of water string in order to determine, if possible, the source of water which entered the well.

Well No. 29, Murphy-Coyote, shut-off. C-186.

Recommended that attempt be made to force cement behind the water string, or deepen well, only through sand encountered, below water string, and pump or bail well for further tests.

Well No. 30, Murphy-Coyote, commence drilling. CC-272.

Proposed depth of water shut off approved.

SECTION 19.

Standard Oil Co.

Well No. 26, drill. CC-149.

Approved estimated depth of water shut off.

Well No. 26, shut-off. C-147.

A production test, after completion of the well, was recommended on account of the bailer having been run several times previous to the arrival of the inspector to witness test.

Well No. 27, drill. CC-150.

Approved proposed depth of water shut off.

Well No. 27, M. C., shut-off. C-183.

A production test was recommended after completion of the well on account of a difference in casing and sand line measurements as a result of which it was not definitely established that bailer went below shoe of water string.

Standard Oil Co.
Well No. 32, commence drilling. CC-263.
Proposed depth of water shut off approved.
Well No. 33, commence drilling. CC-303.
Proposed depth of water shut off approved.

SECTION 22.

Union Oil Co.
Well No. 1, Toussou, abandon. CC-127.
Approved proposed method of abandonment.
Well No. 3, San Juan, abandon. CC-128.
Approved proposed method of abandonment.
Well No. 17, drill. CC-198.
Recommended that water be shut off about 270′ deeper than proposed by company.

Standard Oil Co.
Well No. 6, Coyote No. 2, abandon. CC-207.
Approved proposal to abandon and indicating the depths at which shooting and plugging should be done.
Well No. 7, Coyote No. 2, abandon. CC-169.
Approved proposal to abandon and indicating depths at which plugging should be done.
Well No. 8, Coyote No. 2, shut-off. C-59.
Test of water shut off approved.
Well No. 9, Coyote No. 2, drill. CC-214.
Approved proposed depth at which water should be shut off.

SECTION 23.

Union Oil Co.
(Hole) No. 6, redrill. CC-164.
Approved proposal to redrill and deepen.
(Hole) No. 8, shut-off. C-60.
Test of water shut off satisfactory. Water was shut off several hundred feet above productive zone in adjoining wells in order to test upper formations.
(Hole) No. 8, shut-off. C-187.
Approved proposal to continue drilling after test of water shut-off was witnessed. Recommended production test after completion on account of water level having been found 73′ below bailing depth reported.
(Hole) No. 9, shut-off. C-82.
Test of shut off satisfactory.
(Hole) No. 9, re-cement. CC-244.
Approved proposal to cement below original point of shut off, after holding conference with representatives of company and adjoining operator.
(Hole) No. 9, shut-off. C-164.
Test of water shut off approved.
(Hole) No. 10, shut-off. C-61.
Test of water shut off approved.
(Hole) No. 11, shut-off. C-64.
Test of water shut off satisfactory.
(Hole) No. 11, shut-off. C-81.
Test of water shut off satisfactory.
(Hole) No. 11, shut-off. C-150.
A letter from the company stated that a sand carrying heavy oil and possibly some water was shut off on account of results obtained in well No. 9, adjoining. The test showed that water was not passing to levels in the well below the point of shut off. Attention of the company was directed to the fact that proposal to shut off upper oil-bearing formations was not received by this department.

Union Oil Co.

No. 11, continue drilling. CC-245.

Approved proposal to continue drilling after holding conference with adjoining operator relative to matter of protection from water of oil-bearing formations which had been shut off.

(Hole) No. 12, shut-off. C-97.

Test of water shut off satisfactory.

(Hole) No. 13, shut-off. C-153.

Test of water shut off satisfactory.

(Hole) No. 14, drill new. CC-143.

Recommend water shut off at a depth of about 3000'.

(Hole) No. 14, shut-off. C-158.

Test of water shut off approved.

(Hole) No. 15, drill. CC-196.

Recommended that company shut off water about 100' lower than proposed in notice of intention to commence drilling.

(Hole) No. 16, drill. CC-195.

Recommended that company shut off water about 100' lower than proposed in notice of intention to commence drilling.

(Hole) No. 18, drill. CC-159.

Approved proposed depth of water shut off.

(Hole) No. 18, shut-off. C-146.

Test of water shut off approved, although water was found 29' below reported bailing depth.

Amalgamated Oil Co.

Well No. 2, Hualde, drill. CC-288.

Recommended that company shut off water above upper oil zone in case it was encountered at this well.

Well No. 8, Hualde, shut-off. C-74.

Test of water shut off satisfactory.

Well No. 10, Hualde, shut-off. C-73.

Test showed that water was not completely shut off. Recommended another shut off at a lower depth.

Well No. 9, Hualde, drill. CC-154.

Approved proposed depth of water shut off.

Well No. 9, Hualde, shut off. C-113.

Test of water shut off satisfactory.

Well No. 9, redrill. CC-211.

Water entered the well subsequent to test of water shut off, and well was shot about 150' above the point of shut-off in order to remove oil string and an 8' plug of lead, wool and iron shavings put in. Approved proposal to shoot and replug well with cement; move derrick and drill new hole. Recommended that company leave conductor casing in well in order that it may be re-entered and additional plugging done if deemed advisable, judging from results at adjoining wells.

Well No. 9, Hualde, remove derrick and redrill. CC-335.

The company submitted a detailed record of work done in shooting and plugging. Approval to move derrick and drill new hole was given.

Well No. 23, Hualde, shut-off. C-91.

Test of water shut off approved.

Well No. 26, Hualde, drill. CC-172.

Recommended that company shut off water about 50' lower than proposed.

Well No. 26, Hualde, shut-off. C-141.

Test of water shut off approved.

Section 24.

Amalgamated Oil Co.

Well No. 40, Anaheim, shut-off. C-87.

Test of water shut off approved.

Amalgamated Oil Co.

Well No. 56, Anaheim, drill. CC-289.

Recommend that company shut off water above an upper oil zone which probably would be encountered in this well and which had been encountered in certain adjoining wells.

The Petroleum Co.

Well No. 1, Gilman, redrill. CC-239.

Approved proposal to set a packer in order to test for possible "top" water.

SECTION 28.

Union Oil Co.

Well No. 6, Bastanchury, drill. CC-122.

Approved depth of water shut-off proposed by company, stating that another and lower shut-off would probably be necessary.

T. 3 S., R. 11 W., S. B. B. & M.

SECTION 4.

Union Oil Co.

Well No. 3, Myer, drill. CC-216.

Approved the estimates received from the company relative to depth of water shut off. This well is located over three miles from the nearest producing well and the depth at which oil-bearing formation may be encountered is unknown.

SECTION 13.

Standard Oil Co.

Well No. 2, redrill. CC-170.

Approved proposal to redrill in order to shut off water.

Well No. 2, Emery, shut-off. C-131.

The results of the test showed water which was probably return drilling water, would enter if well was bailed below a depth of 2350'. Recommended production test be made 90 days after completion of redrilling work. Production reports show that the well produced 0.1% water in June, 1917, indicating a satisfactory shut-off.

Well No. 5, redrill. CC-212.

Approved proposal to remove oil string and attempt to force cement behind the water string, to shut off water.

Well No. 5 Emery, shut-off. C-159.

Test of water shut off showed that water was not descending into the well from above the shut-off point and was approved.

Well No. 5 Emery, redrill. CC-336.

The company proposed to plug the bottom of well up into the water string and perforate the water string to test oil-bearing formations formerly shut off. Recommendations were made by this department to plug the bottom of the well by stages in order, if possible, to locate the source of the water. Approved proposal to perforate water string and test the well after bottom of well had been plugged.

Well No. 13, abandon. CC-174.

Recommended shooting and plugging at certain specified depths.

Well No. 27, drill. CC-117.

Approved proposed estimated depth for shutting off water.

Well No. 27 Emery, shut-off. C-104.

Test of water shut off approved.

Well No. 28, drill. CC-152.

Proposed depth of water shut off satisfactory.

Well No. 28 Emery, shut-off. C-123.

Test of water shut off satisfactory.

SECTION 24.

Standard Oil Co.

Well No. 5, McNally, shut-off. C-108.

Test of water shut off approved.

Well No. 26, shut-off. C-68.

Test of shut off approved.

Well No. 29, drill. CC-151.

Approved proposal depth of shutting off water.

Wel' No. 29, Emery, shut-off. C-142.

Test of shut off approved.

Well No. 30, drill. CC-148.

Approved proposal depth for shutting off water.

Well No. 30, Emery, shut-off. C-122.

Test of water shut off approved.

Well No. 31, Emery, shut-off. C-173.

The results of the test showed that water from above the shut-off point was not passing to lower levels in the well.

Well No. 32, test water string. CC-296.

Approved proposal from company to try for circulation and pump cement back of water string. Recommended that company test water string by plugging well with cement below the shoe of this casing. Attention of company was called to their failure to notify the department relative to depth at which water string was to be cemented.

Well No. 32, Emery, shut-off. C-189.

The results of the test witnessed by a member of the department showed that water was not shut off. Approved proposal from company to again try and force cement back of water string.

Well No. 33, drill. CC-283.

The estimated depth for shutting off water, proposed by the company, was approved.

OLINDA FIELD.

This field takes its name from the oil town of Olinda, located on the A. T. & S. F. Ry. in Section 9, T. 3 S., R. 9 W., S. B. B. & M. It includes all of Sections 3, 4, 5, 6, 7, 8, 9, and 10 and north half of Sections 16 and 17, T. 3 S., R. 9 W., and the S. E. ¼ of Sec. 1, and all of Sec. 12, T. 3 S., R. 10 W. The producing wells in general follow a line of foothills parallel to the La Habra Valley on the north at its eastern extremity.

GENERAL GEOLOGY.

The structure of the Olinda field is very similar to the structure of the Whittier field. The Fernando formation rising out of the La Habra Valley attains an elevation of about 250′ above the floor of the valley, then plunges into the fault zone developed along the contact of Fernando and Monterey formations.

Study of a peg model and cross sections made by this department of a portion of the field shows a dip of 34° S. 23° W. in the SW. ¼ of Section 8, T. 3 S., R. 9 W.

Two distinct oil horizons have been penetrated by drilling in this field. The upper zone is associated with conglomerate beds which

probably mark the base of the Fernando. The lower zone is encountered at a distance of about 700-800 ft. below the top of the upper zone and the oil-bearing formations probably are of Puente or Monterey age. The gravity of the oil produced from the two zones varies with the depth at which the zones are encountered, the oil produced from the lower zone being lighter in gravity than oil from the upper zone at the same location.

Wells down the dip in the southern part of Section 8, T. 3 S., R. 9 W., produce from the upper zone only, while wells near the center of Section 8 produce from both upper and lower zones, and wells in the north half of this section near the outcrop of the upper zone, where the oil is heavy, produce mainly from the lower zone.

The general dip of the formations south and west brings the conglomerate oil zone to the surface in outcrop on the south flank of the anticline in the N. W. ¼ of Sec. 8, T. 3 S., R. 9 W. The outcrop is evidenced by numerous seepages.

The rise of formations toward the east, and the faulting near the center of Sec. 9, T. 3 S., R. 9 W., have combined to raise an oil horizon which is probably stratagraphically lower than the lowest horizon from which wells are producing to the west, possibly accounting for the lighter gravity of oil produced by wells in this vicinity.

The further rise of oil-bearing formations toward the east and the subsequent erosion and exposure of these formations, define the limits of production on the eastern extension of this field.

The Olinda field adjoins and is a natural extension of the Brea Cañon field to the west.

PRODUCTION AND WATER CONDITIONS.

There are 251 producing wells in this field which, according to Table No. 1, produced 7,598 bbls. of oil and 926 bbls. of water per day during the month of June, 1917, or a daily average of 30 bbls. of oil and 3.7 bbls. of water per well day. This table shows that the amount of water produced during the month of June amounted to 10.8% of the total amount of fluid produced by these wells.

Monthly production reports for June and map prepared showing relative amounts of water produced by individual wells show that 14 wells produced daily a total of 574 bbls. of water, or more than one-half of the amount of water produced by the field. The remaining 237 wells produced 352 bbls. of water, or an average of 1½ bbls. of water per day.

It has been the practice of some of the companies in this field to drain off all free water from receiving tanks at the wells and furnish this department with a record of the amount and percentage of water remaining in the oil after this has been done. One company in this

field has recently changed their system of furnishing production reports after it had been pointed out by this department that the former method of reporting amount and percentage of water for each well was incorrect.

No doubt the amount and percentage of water shown by our tabulations will be greatly increased when all companies in this field have furnished this department with correct production reports showing the total amount of water produced by various wells.

SUMMARY OF NOTICES AND DECISIONS.

Following is a summary of notices received and decisions rendered by this department for the Olinda field during the past year. Reference to this table shows that most of the development in this field was carried on by the Petroleum Development, West Coast and Union Oil companies, and relates primarily to the drilling of new wells.

Section	Township	Range	Company	New wells		Test of water shut off		Deepen or redrill		Abandon	
				Notices	Decisions	Notices	Decisions	Notices	Decisions	Notices	Decisions
7	3	9	Union	1	1						
8	3	9	Pet. Dev.	5	6	4	7	1	1		
8	3	9	West Coast	6	6	3	6	1	1		
8	3	9	Union	4	4						
8	3	9	Col. Oil Pro.	2	1	2	2				
8	3	9	Olinda Land			1	1				
16	3	9	Olinda Land			1	1				
17	3	9	Union			1	1				
24	3	9	Yorba Oil							1	1
			Totals	18	18	12	18	2	2	1	1

NEW DEVELOPMENTS.

During the fiscal year drilling was commenced at 16 new wells, two wells were redrilled and one well abandoned in the Olinda field.

There are now approximately 1541 acres of proven oil land in this field. Proven territory has been recently extended some distance to the south by the completion of Union Oil Co. "G. & L." Well No. 50, which is located along the north line in the N. W. $\frac{1}{4}$ of Sec. 17, T. 3 S., R. 9 W.

Following is a list of all decisions rendered covering operations at wells in this field for the past year, accompanied by brief descriptions showing the character of work done at each well included in the list, and recommendations made by this department.

DECISIONS.

T. 3 S., R. 9 W., S. B. B. & M.

SECTION 7.

Union Oil Co.

Well No. 8, Naranjal, drill. CC-145.

The company proposed to shut off water at a depth of about 2400'. Recommendation was made by this department to shut off at a depth of 2850'.

SECTION 8.

Petroleum Development Co.

Well No. 24, shut-off. C-72.

This well was deepened, after which production test was witnessed and approved as satisfactory.

Well No. 26, shut-off. C-98.

Production test thirty days after well had been deepened showed a cut of 3% water in 30 barrels of fluid. Test approved.

Well No. 31, shut-off. C-56.

Production test made after well had been deepened. Test approved as satisfactorily showing that well made no water.

Well No. 47, deepen. CC-266.

Approved proposal to deepen well from 2415' to about 3000'. The results of this work increased the production about 1000 bbls. of oil per month.

Well No. 74, shut-off. C-133.

The 12½" casing did not completely shut off the water. The 10" casing was landed at a depth of 1607'. Department not notified for test of shut off with this casing. Letter received from company giving results of test of 12½" casing. Recommended production test 90 days after completion of the well.

Well No. 75, commence drilling. CC-113.

The company expected to encounter water between 700 and 800'. Recommended that the company watch formations carefully and shut off water when found.

Well No. 76, begin drilling. CC-137.

Approved proposal of company to shut off water at a depth of about 800'.

Well No. 76, shut-off. C-132.

Written notice of test of water shut-off not received; however, test was witnessed by a member of this department and approval given to continue drilling.

Well No. 77, drill. CC-162.

Recommended that company shut off water at the depth proposed in the notice of intention to commence drilling.

Well No. 77, shut-off. C-148.

Test of shut off approved as satisfactory.

Well No. 78, drill. CC-199.

Approved proposal from the company to shut off water at the depth indicated in the notice of intention to commence drilling.

Well No. 78, shut-off. C-168.

Test of water shut off approved.

Well No. 79, commence drilling. CC-293.

Approved proposal from the company to shut off water at the depth indicated in the notice to commence drilling.

Well No. 80, commence drilling. CC-314.

Proposed depth of water shut off approved.

West Coast Oil Co.

Well No. 54, drill. CC-157.

Approved proposal from the company to shut off water at a depth indicated in the notice to commence drilling.

Well No. 54, shut-off. C-127.

Test of water shut off approved as satisfactory.

West Coast Oil Co.

Well No. 63, commence drilling. CC-337.

Approved proposed depth for shutting off water.

Well No. 65, shut-off. C-58.

Test showed water rising about 20″ per hour, due to casing leak. Recommended that company complete the well and shut off water with a packer.

Well No. 68, commence drilling. CC-339.

The company proposed to shut off water at a depth of about 2500′. Study of a peg model made by this department indicated that water should be shut off at about 2300′. The company was requested to furnish log of well after a depth of 2000′ had been reached in drilling, so that further study could be made regarding proper shut-off depth.

Well No. 70, shut-off. C-57.

Test showed that water was not completely shut off. Recommended test of upper oil sands, suggested probable necessity of another shut-off at a lower depth. This well was completed without making additional shut-off and since completion made an average of about 18% water.

Well No. 74, commence drilling. CC-338.

The company proposed to shut off water at a depth of 2500′ Study of peg model indicated that water should be shut off at a depth of about 2350′ in order to test the contents of the oil-bearing formations which would probably be encountered just below the latter depth.

Well No. 80, redrill. CC-158.

Approved proposal to move derrick and drill new hole. The company proposed to shut off water at a depth of 2400′. Recommended that water be shut off at depth proposed.

Well No. 80, shut-off. CC-203.

Approved proposal to drill through sand encountered at 2395′ and shut off water in suitable formation below this sand.

Well No. 80, shut-off. C-151.

Approved test of water shut off with 10″ casing cemented at 2420′.

Well No. 84, drill. CC-173.

Recommended that water be shut off at a depth of 1950′, instead of about 2500′, as proposed. Letter subsequent to this decision, confirming conference with representative of the company recommended that water string be landed at a depth of 1800′.

Well No. 84, cement. CC-230.

Approved proposal to drill into and shut off water in shale body which was expected to be encountered below conglomerate encountered at 1583′.

Well No. 84, shut-off. C-161.

Approved test of water shut off with 10″ casing cemented at 1915′.

Union Oil Co.

Well No. 6, Naranjal, drill. CC-147.

Recommended that water be shut off at about 2550′, instead of 2400′ as proposed by the company.

Well No. 6, Naranjal, cement. CC-318.

Approved proposal to continue drilling below a depth of 2640′ until a showing of oil had been encountered. This decision was made after a conference with neighboring companies.

Well No. 7, Naranjal, drill. CC-146.

Recommended that water be shut off at a depth of about 2750′ instead of 2400′ as proposed by the company.

Well No. 10, Naranjal, drill. CC-144.

Recommended that water be shut off at a depth of about 2050′ instead of 2400′ as proposed by the company.

Columbia Oil Producing Co.
Well No. 28, shut-off. C-106.
Test of water shut off, satisfactory.
Well No. 29, commence drilling. CC-229.
Notice of commencement of drilling stated that productive oil sand should be encountered at a depth of from 1200′ to 1600′ and that no water should be encountered above these depths. Recommended that this department be notified for test of water shut-off after landing casing above productive oil formations.
Well No. 29, shut-off. C-181.
Recommended production test thirty days after completion of well on account of results of test failing to show that hole was open or drilled below shut-off point.

Olinda Land Co.
Well No. 17, shut-off. C-137.
On account of slight change in water level while standing bailed for test, recommended production test 90 days after completion of well.

SECTION 16.

Olinda Land Co.
Well No. 18, shut-off. C-94.
The test showed that water was not shut off. Recommended cementing another string of casing at a lower depth.

SECTION 17.

Union Oil Co.
Well No. 50, G. & L.,shut-off. C-139.
Test satisfactory.

SECTION 24.

Yorba Oil Co.
Well No. 2, abandon. CC-160.
Approved proposed method of abandonment.

BREA CAÑON FIELD.

GENERAL DESCRIPTION.

Brea Cañon field takes its name from Brea Cañon, in which the pioneer wells of the field were located. Brea Cañon, as the name implies, drains a region in which are numerous oil seepages and the early wells drilled in this field followed the lines of seepage.

For the purposes of mapping and for convenience in the filing of records, the following described government subdivisions have been included in this field: The N. ½ and S. W. ¼ of Section 1, and all of Sections 2 and 3 of T. 3 S., R. 10 W., S. B. B. & M.

The geology of this field has been described in detail in Bulletin No. 309, of the U. S. Geological Survey, and in various publications of the State Mining Bureau.

PRODUCTION AND WATER CONDITIONS.

Table No. 1 shows that there were 62 wells producing during the month of June, 1917. These wells produced a total of 141,496 barrels of oil and 60,961 barrels of water during this month. Fifteen wells

in this field produced a total of 57,203 bbls. of water, or 93.8% of all water produced in the field.

Bulletin No. 73, First Annual Report of this department, showed a monthly production of about 170,000 bbls. of oil and about 44,000 bbls. of water per month (for the corresponding month a year ago). This is a decrease of about 28,500 bbls. of oil and an increase of about 17,000 bbls. of water per month.

Study of monthly production report and map prepared by this department, showing the relative amounts of water produced by each well, show that serious water conditions exist in the western and the southwestern part of this field.

The general belief held by operators in this field that most of the water produced is return drilling water is not borne out by the increase of water produced, and on account of the comparatively small number of wells drilling during the past year. However, there are certain wells which are known to have been affected while adjoining wells were being drilled through the oil-bearing formations.

Well No. 12 of the Birch Oil Co., in Section 2, T. 3 S., R. 10 W., was drilled to a depth of nearly 4500′. This well was completed September 8, 1916, and produced for about nine months at a rate of about 250 bbls. of fluid per day, of which about 85% was water.

Recommendations were made by this department to the company to plug the lower portion of the well. The results of this plugging increased the production of oil about 5 bbls. and decreased the amount of water about 170 bbls. per day over the first year's average daily production. Further plugging at this well may be necessary in order to completely shut off the water.

The results obtained at this well and the beneficial results obtained from plugging the lower portion of General Petroleum Corporation's Well No. 33, located in the same section, show that a number of other deep wells in this vicinity may be benefited by a similar treatment.

Four wells in the N. E. ¼ of the N. W. ¼ of Section 2, T. 3 S., R. 10 W., averaged over 3500 bbls. of water each during the month of June, 1917. The source of water entering these wells has not been definitely determined.

One well located in the S. W. ¼ of the N. W. ¼ of Section 1, T. 2 S., R. 12 W., produced a total of 3750 bbls. of water during June, 1917.

Wells producing large amounts of water are fairly well distributed throughout the producing area of this field.

The following summary of notices received and decisions made by this department for this field during the past year shows that drilling was commenced at two new wells.

Section	Township	Range	Company	New wells		Test of water shut off		Deepen or redrill		Abandon	
				Notices.	Decisions.	Notices.	Decisions.	Notices.	Decisions.	Notices.	Decisions.
1	3 S	10 W	Brea Canyon	------	------	2	1	------	------	------	------
2	3 S	10 W	Birch Oil	1	1	1	1	1	2	------	------
2	3 S	10 W	Brea Canyon	1	1	------	------	1	1	------	------
			Totals	2	2	3	2	2	3	------	------

The proved area of this field has not been extended during the past year, and may be accounted for by the comparative inactivity in drilling operations.

Following is a list of all decisions made during the past year relative to operations in this field.

DECISIONS.

T. 3 S., R. 10 W., S. B. B. & M.

SECTION 1.

Brea Cañon Oil Co.

Well No. 29, shut-off. C-109.

Test showed that 15½" casing excluded water above a depth of 1211'.

SECTION 2.

Birch Oil Co.

Well No. 12, redrill. CC-313.

Approved proposal to redrill and plug the bottom of the well, indicating depths at which shooting and plugging should be done.

Well No. 12, redrill. CC-317.

Approved proposal to make minor change in depth at which one of the various plugs, recommended in No. CC-313, should be placed.

Well No. 14, drill. CC-187.

Approved estimated depth of water shut-off.

Well No. 14, shut-off. C-129.

Test of water shut off approved.

Brea Cañon Oil Co.

Well No. 14, deepen. CC-200.

Proposal to deepen approved.

Well No. 30, commence drilling. CC-236.

Estimated depth of water shut off approved.

PUENTE FIELD.

The limits of the producing area of this field were originally confined within the boundaries of Sections 34 and 35, T. 2 S., R. 10 W., S. B. B. & M., Los Angeles County, and referred to the development of this portion of the Puente Hills only. Because of the decline in

production and development in the old field, and recent drilling operations in various portions of the Puente Hills, it has been deemed advisable to include in the Puente field all of the region covered by the Puente Hills, with the exception of territory mapped in the Olinda, Brea Cañon and Whittier fields described elsewhere.

A detailed history of the Old Puente field as given in Bulletin No. 63 of the California State Mining Bureau, shows 72 wells drilled by Rowland and Lacy, 11 wells drilled by the Puente Oil Co. on the Rowland lease, and 5 wells drilled by the Menges Oil Co., all in Sections 34 and 35, T. 2 S., R. 10 W. These three properties are now under lease to the Columbia Oil Producing Company.

Out of a total of 88 wells drilled in this area during the period from 1880-1911, 44 wells are producing and 44 are idle or abandoned, at the present time. The production of the old Puente field amounted to about 2000 bbls. gross during the month of June, 1917, of which 5.4% was water. Production per well varies from 4 to 185 bbls. per month and the wells are pumped on an average from 1 to 4 days per month. Some of the wells in this group have been producing for over 20 years.

The Copa de Oro Petroleum Co. commenced drilling Well No. 1, on Section 20, T. 2 S., R. 9 W., in February, 1916. This well was drilled to a depth of about 3400′ without developing oil in commercial quantities. A study of the geology of this area as mapped by Bulletin No. 69, California State Mining Bureau, shows that this well was located on an anticline in the sandstone of Monterey age.

The Gold Seal Petroleum Company commenced drilling Well No. 1, Section 16, T. 2 S., R. 9 W., in March, 1916. The log of this well has not been received.

A. T. Currier Well No. 1, Section 17, T. 2 S., R. 9 W., was drilled to a depth of 4173′, and, according to the log, oil showings were recorded in this well at depths of about 1200′ and 3000′. Drilling operations are now suspended.

WHITTIER FIELD.

There are about 501 acres of proved land in this field. The following companies were operating here during June, 1917: Standard Oil Company, Central Oil Company of Los Angeles, Colorado Oil Company, Whittier Crude Oil Co., Home Oil Company and Union Oil Company. According to June production reports, there were 139 producing wells which made a total of 96,646 barrels of clean oil and 78,711 barrels of water. There were 244 wells drilled in this field, of which number 105 were idle, or abandoned. Some of the abandoned wells were drilled many years ago and were not deep enough to encounter oil. Others were abandoned on account of mechanical

difficulties after oil bearing formations had been encountered. A number of wells were abandoned or shut down on account of small production.

It is interesting to note that Well No. 1 of the Central Oil Co., located in Section 23, T. 2 S., R. 11 W., S. B. B. & M., was completed over 20 years ago and is still producing a small amount of oil.

GEOLOGY.

The general structure of the Whittier field is due to faulting probably along an unconformable contact between Fernando and Puente formations, giving rise to an anticlinal structure facing the La Habra Valley, which structure is responsible for the accumulation and storage of oil in the formations directly beneath (capping) beds of Fernando age. The surface geology of this field has been described in detail in U. S. Geological Survey Bulletin No. 309, and in Bulletins Nos. 63 and 69 of the State Mining Bureau.

In previous publications, the underground structure of this field had been considered complex and considerably broken up as a result of faulting. This appears to be true in the fault zone. Recent developments and a detailed study from peg models and cross sections made by this department of the area included in Sections 22, 23 and 26, T. 2 S., R. 11 W., reveals conformity of underground structure to surface exposures. The south flank of the Whittier anticline in this area is a simple monocline.

A study of logs of old wells reveals little regarding underground conditions on account of poor records kept by early operating companies.

A study of the peg model shows that three distinct oil zones have been penetrated and that intermediate water probably lies between these zones. It is worthy of note that the zones are found at fairly uniform stratagraphic depths by wells penetrating them, and by application of information shown by the log records, the depths at which these zones should be encountered may be anticipated at uniform stratagraphic depths in new wells drilled in this area.

These oil zones in general are uniformly parallel. The distance from the top of the first zone to the top of the second zone averages about 500′. The average distance from the top of the second zone to the top of the third zone is 600′. The first and second zones are each approximately 200′ in thickness. There is no definite information as to the thickness of the third zone in this area, on account of the comparatively small number of wells which have passed through this zone.

Logs of some of the wells penetrating this zone indicate a thickness of approximately 1000′. Some of the wells have probably passed through the third zone and are producing from a possible fourth zone.

The two upper oil zones encountered on Sections 26, T. 2 S., R. 11 W., outcrop in succession before reaching the apex of the fold in the S. W. $\frac{1}{4}$ of Section 23, T. 2 S., R. 11 W., S. B. B. & M., and the water sands below the second oil zone probably also outcrop in this area. This condition creates a narrow strip of territory running northwest and southeast along the crest of the anticline in which wells drilled into the third zone do not encounter water bearing formations which are penetrated by wells drilled on either flank of the anticline, A number of deep wells drilled near the apex of the anticline are producing oil which is from 5° to 8° B. lighter in gravity than the oil produced from the third zone in the same locality. This production is probably obtained from the fourth zone, which does not contribute to the production of present wells drilled in the area to the south.

WATER CONDITIONS.

The water conditions in portions of this field are serious.

Some of the early wells drilled did not effectively prevent water from above the oil sands from entering the producing formations. Water was not shut off at uniform stratagraphic depths in some of the wells drilled in this field. This may be largely attributed to the incomplete knowledge regarding geological conditions. Work done in abandoning wells previous to the inauguration of this department was, in many cases, improperly done and damage to oil deposits may be ensuing.

The source of the greater portion of the water trouble in this field probably results from water bearing formations having been penetrated between the oil zones without protecting the various zones from this water.

The policy of supervising the drilling of new wells has been that each oil zone penetrated should be protected from water. This is accomplished by the co-operation of operators with this department.

The production of all wells completed during the fiscal year, with one exception, is comparatively free from water, showing that it has been profitable to employ scientific methods in drilling new wells in this field.

FUTURE DEVELOPMENTS.

A number of old wells in Sections 22 and 23, T. 2 S., R. 11 W., have been deepened and the production of oil materially increased.

The line of development during the past year has been along the south flank of the anticline and particularly in Section 26, T. 2 S., R. 11 W. The proven area of the field has been extended in this direction and the results indicate a further extension of proven area

during the coming year. It would seem advisable and necessary to repair or abandon and plug certain old wells which produce comparatively small amounts of oil and large amounts of water in order to eliminate some of the water trouble, and protect the territory.

The following is a summary of notices received and decisions rendered during the past year:

Section	Township	Range	Company	New wells		Test of water shut off		Deepen or redrill		Abandon	
				Notices	Decisions	Notices	Decisions	Notices	Decisions	Notices	Decisions
22	2 S	11 W	Central	1	1			3	3		
22	2 S	11 W	Standard	2	1	3	2	2	2		
22	2 S	11 W	Home					2	2		
23	2 S	11 W	Central							1	1
26	2 S	11 W	Standard	6	6	14	11	1	1		
			Totals	9	8	17	13	8	8	1	1

Following is a list of decisions rendered covering operations at wells in this field for the past year, accompanied by a brief description showing character of work done at each well and recommendations made by this department:

DECISIONS.

T. 2 S., R. 11 W., S. B. B. & M.

SECTION 22.

Standard Oil Co.

Well No. 11 (Fidelity) Shutoff. C-101.

Results of test did not show that water was completely shut off. Recommended pumping well for further test.

Well No. 11, (Fidelity), redrill. C-165.

Approved proposal to redrill and deepen. Previous production test indicated that water was shut off.

Central Oil Co.

Well No. 2-C, deepening. CC-135.

Recommended that company shut off water before deepening into lower oil sands.

Well No. 30-B, deepening. CC-114.

Recommended shutting off water before deepening.

Well No. 31-B, drilling. CC-210.

Approved proposed depth of water shut off.

Well No. 38-B, deepening. CC-134.

Approved proposal to deepen.

Standard Oil Co.

Well No. 10, Fidelity, deepen. CC-136.

Approval to deepen was given, providing company shut off "top" water.

Well No. 12, Savage, shut-off. C-157.

The results of the test indicated that water from the shut-off point was not passing to lower levels in the well. There was no definite evidence to show that oil-bearing formations above the shut-off point were protected from water.

Standard Oil Co.

Well No. 14, Savage, drill. CC-156.

Approved proposed shut-off depth and recommended that heavy mud be circulated in well to protect oil-bearing formations above shut-off point and that results be carefully watched in surrounding wells.

Home Oil Co.

Well No. 16, redrill. CC-253.

Approved proposal to redrill and clean out in order to test a sand formerly shut off.

Well No. 20, redrill. CC-254.

Approved proposal to redrill and plug bottom of well and produce from upper formations.

SECTION 23.

Central Oil Co.

Well No. 24-C, abandon. CC-324.

Approved proposed method of abandonment.

SECTION 26.

Standard Oil Co.

Well No. 42 MW, shut-off. C-95.

Test of water shut off approved.

Well No. 42 MW, shut-off. C-100.

Test of water shut-off satisfactory.

Well No. 44 MW, shut-off. C-121.

Test of water shut off above the first oil zone approved.

Well No. 44 MW, shut-off. C-154.

8¼" casing cemented above the second oil zone and the test showed that water from above the shut-off point was not passing to lower levels in the well. No evidence was presented by the company to show that the first or upper oil zone had been protected from probable water between the first and second oil zones.

Well No. 45 MW, shut-off. C-125.

Water was shut off above the first oil zone and test of shut off approved.

Well No. 46 MW, drill. CC-183.

The company proposed to shut off water at a depth of about 1600′ in order to test sands carrying heavy oil. This department recommended that water be shut off below these sands. After some correspondence, approval was given to shut off water above the heavy oil sands. The cementing job failed and water was later on shut off below the heavy sands, or first oil zone.

Well No. 46 MW, shut-off. C-182.

10″ casing was cemented below the first oil zone and above the second oil zone. The results of the test demonstrated that water from above the second oil zone was not passing to lower levels in the well.

Well No. 47 MW, commence drilling. CC-227.

Approved proposed depth for shutting off water.

Well No. 47 MW, shut-off. C-155.

10″ casing was cemented above the second oil zone and test of water shut off approved.

Well No. 48 MW, commence drilling. CC-251.

Recommended that the company shut off water above the first oil zone in addition to their proposed work of shutting off water immediately above the second zone.

Well No. 48 MW, shut-off. C-184.

Water shut off above the first oil zone and test of shut-off approved.

Well No. 39 MW, shut-off. C-62.

Test of water shut-off approved.

Well No. 40 MW, shut-off. C-89.

Test of water shut-off approved.

Well No. 41 MW, shut-off. C-105.

Test of water shut-off approved.

Standard Oil Co.

Well No. 41 MW, production test. CC-282.

Test of water shut off above upper oil sands was approved by this department. The company deepened the well and encountered water below the upper oil sands and attempted to shut off water by pumping cement through the perforations in the 8¼" oil string. After failing to shut off the water, the 6¼" casing was cemented and also failed to effect a shut-off. Approval was given to clean out the well and make a production test. Attention was called to the unprotected condition of oil sands which were shut off and that these sands were shut off without the approval of this department. After receiving approval to make production test, the company drilled the well 228' deeper and at present the well averages about 16 barrels of oil and over 200 barrels of water per day.

Well No. 42 MW, deepen. CC-265.

Data compiled by this department showed that the upper oil sands were protected from entrance of water above them. Approved proposal to deepen.

Well No. 49 MW, shut-off depth. CC-305.

The company originally proposed to shut off above the second oil zone and later filed notice of intention to make an additional shut-off above the first zone. The latter proposal received the approval of this department.

Well No. 50 MW, commence drilling. CC-231.

The proposed depth of water shut off was approved.

MONTEBELLO FIELD.

The Montebello Oil Field is situated about one mile north of, and derives its name from, the town of Montebello, a small town on the Whittier highway, about half way between Whittier and Los Angeles.

It occupies the crest and flanks of an anticlinal dome known as the La Merced Hills, which form a spur extending in an east-west direction from the eastern extremity of the Rapetto Hills, both ranges merging and passing beneath the narrow valley formed by the Rio Hondo and San Gabriel rivers.

TOPOGRAPHY.

The La Merced Hills, comprising the region of the newly developed oil field, appear topographically as a low range of hills, striking almost east and west through the northern part of Sections 1, 2 and 3, T. 2 S., R. 12 W., S. B. B. & M., and Section 6, T. 2 S., R. 11 W., and through the southern portion of Sections 35 and 36, T. 1 S., R. 12 W.

Erosion has not yet effaced the evidences of the original dome contours, the hill appearing to rise gently from the valley floor, the longer axis being east and west, and the crest of the dome being somewhat east of the center of the hill. The eastern limit of the hills has been truncated by erosion of the Rio Hondo river, which here rises to the surface over the eroded edges of the bed rock formations composing the hill to disappear again in the gravels in the channel to the south.

The north flank of the La Merced Hills extend into a low range of hills trending approximately north 70° W., known as the Rapetto Hills. The latter extend from the San Gabriel valley at this point to the northern portion of Los Angeles City, forming the main topographic relief between East Los Angeles and the Puente Hills.

GEOLOGY.

Pleistocene: Examination of the surface exposures of La Merced Hills shows formations of Pleistocene and Fernando ages only. Pleistocene river gravels flank the hills on all sides, except the eastern end, where the Rio Hondo river cuts across the range. The gravels, which, at some previous time, may have covered the entire range, have been eroded from the crest of the hill, exposing the underlying formations of Fernando age. The thickness of the pleistocene varies from zero feet at the contact with the Fernando, to several hundred feet on the sides of the hill and in Sycamore Cañon to the north, and the color is reddish brown, characteristic of the pleistocene river gravels of California. These gravels furnish an excellent soil for the citrus orchards which lie at the base and part way up the sides of the hill.

Fernando: Beneath the pleistocene gravels lie apparently conformable sands and shales of upper Fernando age. The Fernando is exposed along the crest and on the east end of the hill and is composed for the most part of soft sandstone and grey sandy shale. Fossil shell remains have been obtained from the river bluffs along Lincoln Avenue.

The thickness of the Fernando formation in the Merced Hills can not be determined from outcrop in these hills. Formations of Fernando age are known to be several thousand feet in thickness in the Puente Hills to the southeast, according to Bulletin No. 309 of the U. S. Geological Survey, but, until some palæontologic evidence has been presented from borings of wells drilled in this field, no definite knowledge can be obtained as to its actual thickness. There is a possibility that beds of hard sandstone and pebble conglomerates encountered at depths of 1500′ to 2000′ by wells which have been drilled in this field, may mark the base of the Fernando formation and that the production which is now being obtained from the field below these hard beds originated from sands and sandy shales of Puente age. The shale bodies of the oil zone are variously logged by drillers as blue and brown shale. In the western portion of the field, showings of oil have also been reported above the hard beds of sandstone, and pebbles. These showings are probably in beds of Fernando age and have not been tested by wells penetrating them.

Puente formation: No evidence of the Puente formations has been found, up to the present time, in outcrop in this area. However, beds of this age are exposed in the Rapetto Hills to the north and west, and are known to underlie beds of Fernando age in the Puente Hills, where they are very important as oil bearing formations.

Structure: The general structure of the Merced Hills, as revealed by numerous dips in beds of Fernando age, and study of a peg model

of the field, constructed by this department, indicate that there is an anticline running east and west and conforming in a general way to the surface contours of the range.

The axis of the anticline appears to rise from the valley on the west in the northern portion of Sections 2 and 3, T. 2 S., R. 12 W., passing through the northern part of Section 1, T. 2 S., R. 12 W., and Section 6, T. 2 S., R. 11 W., where the structure is masked by the river gravels of the Rio Hondo river. The logs of wells drilled close to the hill and in the river bed indicate a steepening of the dip on the flanks of the anticline in this area, or a plunge in the axis of the anticline itself toward the east.

The surface dips in the Fernando, as measured on the south flank of the anticline, are greater than corresponding dips on the north flank.

The anticline of La Merced Hills is succeeded to the north by a syncline, with possible minor folding as the structure merges into the Rapetto Hills. However, the major structure is so masked by pleistocene deposits that the interpretation of this structure may finally have to rest with prospective wells drilled in this area.

The underground structure of the oil horizon as revealed by cross-sections and peg model of this field, shows in a general way conformity to the structure as mapped on the surface, and already described.

However, the dip between top of oil sands recorded in logs of Standard Oil Co. "Baldwin" No. 2, and Union Oil Co. "La Merced" No. 1, Section 1, T. 2 S., R. 12 W., is 8°. Surface dips of Fernando formations exposed between these wells range from 25° to 50°, the greater dip being recorded in down the slope portion of the area in which these wells have been drilled.

The fact that oil has been encountered on the property of the Union Oil Company, "La Merced" Well No. 1, at a less depth stratagraphically than indicated by surface dips and study of log records of Standard Oil Company wells near the axis of the anticline, shows either a change in dip of the Fernando not shown on the surface, or the presence of an upper oil horizon which is either barren or not recorded in wells drilled near the top of the anticline.

The gravity of the oil produced by the Union "La Merced" No. 1, is about 3° Baumé heavier than the oil produced by Standard "Baldwin" Well No. 2.

Out of a total of 30 wells shown by the peg model as drilling or completed at present writing, 17 are located close to and parallel with the axis of the anticline, throughout its extent, where shown on the surface. A correlation of oil bearing formations and the beds of hard sandstone and pebble conglomerate previously mentioned, and penetrated by

these wells, shows a gradual and fairly uniform rise of the axis from west to east. Wells near the eastern end of the present producing area penetrate oil bearing formations at a depth of about 1100′ below sea level.

HISTORY OF DEVELOPMENT.

The Montebello Field, the latest and one of the most important additions to the oil fields of California, has lain in the center of an oil producing belt in Southern California for years, undiscovered. Many attempts have been made to follow the oil belt between the Whittier and Los Angeles City fields, but without success, as shown by numerous wells drilled in the Rapetto Hills (see page 333, Bulletin No. 63 of the California State Mining Bureau).

The discovery of this field is due solely to scientific geological study, and not as the result of development along oil seepages. Drilling was commenced by the Standard Oil Company on the first well in this field, on December 12, 1916. This well was completed February 24, 1917, opening up a new field which promises to rank among the most productive fields in the state. This was the first well completed in this field, and made an initial production of about 650 bbls. of oil per day, at a depth of 2395′, which production it has maintained with but slight decrease up to the present time. Four wells have been completed by the Standard Oil Co. and one by the Union Oil Co. In addition, there are 25 drilling wells and 4 new derricks.

Among the companies operating in this field are the following: Pan-American Petroleum Co., Interstate Oil Co., Riverside Portland Cement Co., Clara Baldwin Stocker, Petroleum Midway Co., Standard Oil Co., Union Oil Co., San Gabriel Petroleum Co., Red Star Petroleum Co., California Star Oil Co., Rich Ranch Co., and the Amalgamated Oil Co.

With the exception of the Interstate Oil and the San Gabriel Petroleum companies, all operators are using the rotary system of drilling, or a combination of rotary and standard systems, the rotary being used to set the water string. It has been claimed by operators using this system that oil showings may be seen in the rotary mud soon after oil bearing formations have been encountered.

The discovery of oil by the Union Oil Company near the base of the Merced Hills has increased activities of oil promoters in leasing prospective oil lands in the valley to the south, some distance from the foot of the hill.

Production: During the month of June, 1917, the production from this field averaged 852 bbls. of oil and no water per day from two producing wells.

At the present time (Dec. 1, 1917) there are 5 wells producing. The total monthly production of these wells amounts to approximately 260,000 bbls. of oil. One of the new wells was drilled to a depth of 3755′, having been drilled 1725′ below the depth of water shut off. This well commenced flowing over the derrick through the $8\frac{1}{4}$″ oil string at an estimated rate of about 15,000 bbls. per day. The well is now under control and flowing at the rate of between 6000–7000 bbls. of about 26° Baume gravity oil per day.

The well is located near the axis of the anticline and the production of the well shows that a prolific zone has been encountered below the upper zone from which adjoining wells produce an average of about 500 bbls. of oil per day. The absence of any great volume of gas with the oil production of this well, in contrast to a number of flowing wells in other fields in the state, is a feature worthy of note.

Water Conditions: A map drawn to a scale of 100′ to 1 inch has been completed showing all of the proved area and including all property on which development work is being carried on. A peg model, constructed to the same scale, is being kept up to date by aid of weekly reports and log records furnished by operators in this field. Particular attention is given by this department to aiding and directing the various companies to shut off water at the proper stratagraphic depth in each new well. Many of the older fields of this state were practically ruined by disregarding such a vital factor, in the rush to produce from gusher sands without any regard for the protection of oil sands shut off, which afterwards acted as conductors of water to neighboring wells drilled into and producing from these oil sands.

The wells already producing in this field average considerably less than 1% of water in their fluid production.

Future Developments: The productive limits of this field have not been determined by present wells drilled. The area in which active drilling operations are being carried on is not confined to the top of the hill, which represents the higher portion of the anticline.

The Amalgamated Oil Company is drilling a well about one mile east of the nearest producing well on the "Temple" lease of the Standard Oil Co., and in line with the projected axis of the anticline.

The Rice Ranch Oil Co. is drilling a well about one mile in a northwesterly direction from the Standard Oil discovery well.

The Pan-American Petroleum Co. is engaged in drilling a well near the western end of La Merced Hills, about 2 miles west of the discovery well in this field.

The results of drilling in progress at these wells is being watched with considerable interest, and further developments will be influenced to a great extent by the drilling in progress.

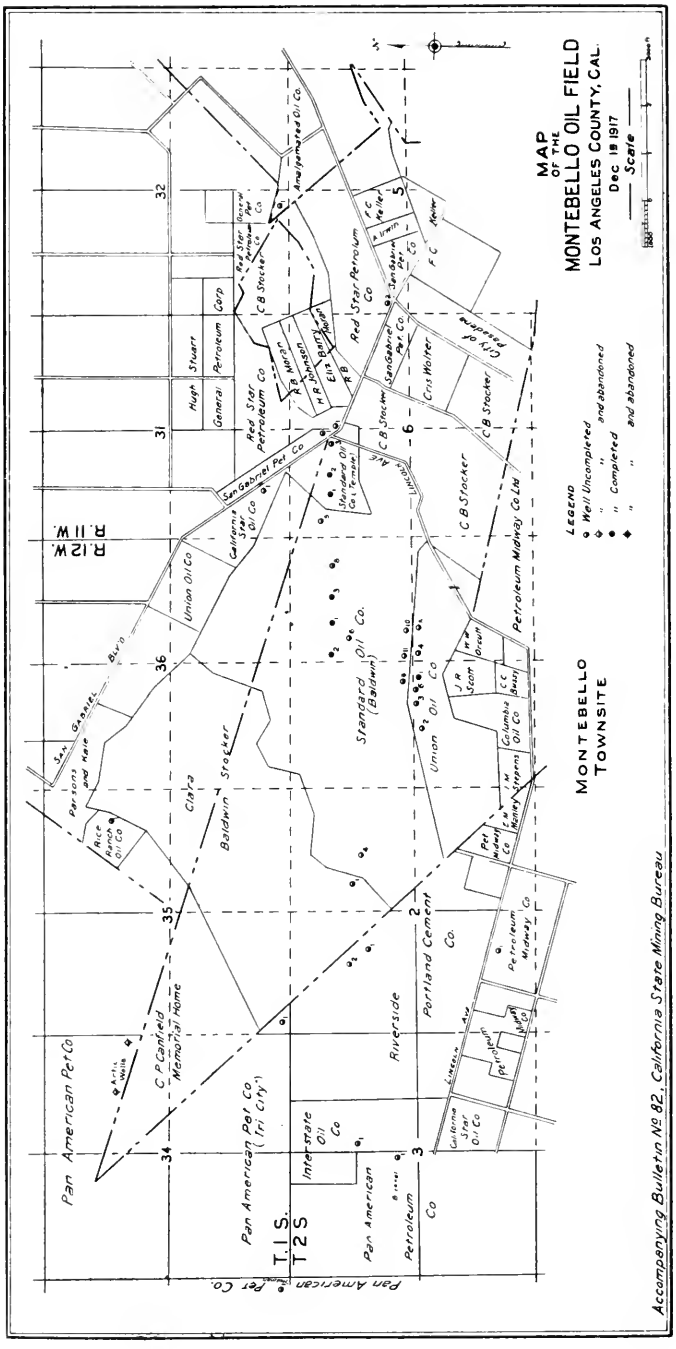

MAP
OF THE
MONTEBELLO OIL FIELD
LOS ANGELES COUNTY, CAL.
Dec 18 1917
Scale
LEGEND
Well Uncompleted
" " and abandoned
" Completed
" " and abandoned
MONTEBELLO
TOWNSITE
Accompanying Bulletin No. 82, California State Mining Bureau
R.12 W.
R.11 W.
T.1 S.
T.2 S.
Pan American Pet Co
Pan American Pet Co (Tri City)
Pan American Pet Co.
Pan American Petroleum Co
Interstate Oil Co
C P Canfield Memorial Home
Riverside
Portland Cement Co.
Clara
Baldwin Stocker
Standard Oil Co. (Baldwin)
Union Oil Co
Petroleum Midway Co Ltd
Petroleum Midway Co
Columbia Oil Co
Cris Wolter
C B Stocker
Red Star Petroleum Co
Hugh Stuart
General Petroleum Corp
Red Star Petroleum Co
Amalgamated Oil Co.
San Gabriel Pet Co
California Star Oil Co
Union Oil Co
Rice Ranch Oil Co
Parsons and Kale
San Gabriel Blvd
Lincoln Ave
Petroleum Ave
Pet Midway Co
Lincoln Ave
California Star Oil Co
Pet Midway Co
Columbia Oil Co
Cris Wolter
Red Star Petroleum Co
Amalgamated Oil Co
Red Star Petroleum Co
Standard Oil Co (Temple)
Lincoln Ave
Pet Midway Co
Lincoln Ave
Petroleum Ave
Pet Midway Co
Columbia Oil Co
Cris Wolter
Red Star Petroleum Co
Amalgamated Oil Co
Red Star Petroleum Co
Hugh Stuart
General Petroleum Corp
Red Star Petroleum Co
Pan American Pet Co.

FIG. 21.

The following is a summary of notices received and decisions rendered by this department for this field during the past year. Reference to this table shows that all of the development in this field related to the drilling of new wells.

Section	Township	Range	Company	New wells		Test of water shut off		Deepen or redrill		Abandon	
				Notices	Decisions	Notices	Decisions	Notices	Decisions	Notices	Decisions
6	2	11	Standard	1	1	1	1				
1	2	12	Union Oil	3	3						
1	2	12	Standard	3	2	1	1				
2	2	12	C. B. Stocker	1	1						
2	2	12	Standard	1	1						
2	2	12	G. W. Improv't (Riv. Portl'd)	2	1						
			Totals	11	9	2	2				

Following is a list of all decisions rendered covering drilling operations in this field during the fiscal year.

DECISIONS.

T. 2 S., R. 11 W., S. B. B. & M.

SECTION 6.

Standard Oil Co.

Well No. 1 (Temple), drilling. CC-221.

Approved proposed depth of water shut-off.

Well No. 1 (Temple), shut-off. C-166.

Test of water shut-off satisfactory.

T. 2 S., R. 12 W., S. B. B. & M.

SECTION 1.

Union Oil Co.

Well No. 1, La Merced, commence drilling. CC-325.

Approved proposed depth for shutting off water. The exact depth at which water should be shut off was unknown on account of the distance from producing wells. Stated that a peg model was under course of construction and that further recommendation may be made at a later date. Subsequent information obtained by the company in drilling the well showed that oil sand was about 100′ less depth than proposed for water shut off. A successful shut-off was made above the oil sand.

T. 2 S., R. 12 W., S. B. B. & M.

SECTION 1.

Union Oil Co.

Well No. 2, La Merced, commence drilling. CC-326.

Approved proposed depth for shutting off water. Stated that a peg model was under construction and that further recommendations may be made at a later date.

Well No. 3, La Merced, commence drilling. CC-327.

Approved proposed depth for shutting off water. Stated that a peg model was under course of construction and that further recommendations may be made at a later date.

Standard Oil Co.
Well No. 1, Baldwin, shut-off. C-135.
Test of water shut-off satisfactory.
Well No. 3, commence drilling. CC-248.
Approved proposed depth for shutting off water.
Well No. 2, commence drilling. CC-228.
Approved proposed depth for shutting off water.

SECTION 2.

Clara Baldwin Stocker.
Well No. 1, commence drilling. CC-286.
Approved proposal estimated depth at which water should be shut off.
Standard Oil Co.
Well No. 4, Baldwin, commence drilling. CC-257.
This well was located nearly two miles from the nearest producing well when decision relative to shut-off depth was made. Approved the proposal received from the company estimating limits between which water should be shut off.
Great Western Improvement Co.
Well No. 1, commence drilling. CC-235.
Approved proposed estimated depth for shutting off water.

SALT LAKE FIELD.

References to the location and geology of this field are given in California State Mining Bureau Bulletin No. 73.

SUMMARY OF WATER CONDITIONS.

During the month of June, 1917, according to the monthly production reports furnished this department, there was a total fluid production of 168,648 barrels. Of this amount, 103,073 barrels were oil and 65,575 barrels were water. Reference to Table 1 shows that there were 243 wells producing. These wells averaged 14 barrels of oil and 9 barrels of water per well per day. Two hundred ten wells in this field produced a total of 19,736 barrels of water, or an average of 3 barrels of water per day each. There were 33 wells producing a total of 45,839 barrels of water, or an average of 46.3 barrels of water per day each. These figures show that the greater portion of the water trouble in this field is confined to a comparatively small number of wells. Study of a map prepared by this department showing the comparative amount of water produced by each well, shows that these wells are located in three well-defined areas, the first along the eastern side of the productive part of the field, in Sections 15 and 22, the second along the western side, in Sections 17 and 20, T. 1 S., R. 14 W. The third area is located in Section 25, T. 1 S., R. 15 W., Beverly Hills.

The source of water entering these wells has not been definitely determined. The fact that the greater portion of the water trouble in this field was confined to certain groups of wells was pointed out in Bulletin No. 73, issued by this department. Remedial work along the lines suggested in this bulletin has been carried on in the western

part of the producing area in Sections 17 and 20, T. 1 S., R. 14 W. Four wells in this area have been abandoned and plugged under the supervision of this department during the past year. These wells were abandoned on account of small production and their general water conditions, and the result of work done should improve the water condition of adjoining wells.

For improvement of general water conditions and increase in production in certain wells in the eastern portion of this field, see accompanying report on method and results of mudding and cementing operations at Rancho La Brea Well No. 41, Section 15, T. 1 S., R. 14 W., page 163.

The following is a summary of notices received and decisions rendered for this field during the fiscal year:

Section	Township	Range	Company	New wells		Test of water shut off		Deepen or redrill		Abandon	
				Notices	Decisions	Notices	Decisions	Notices	Decisions	Notices	Decisions
20	1 S	14 W	Jas. F. Ross	2	1		1				
20	2 S	14 W	Garbutt Oil							4	4
28	1 S	14 W	E. A. Clampitt (Arthur Melton)	2				2	2		
25	1 S	15 W	West Coast			1		1	1		
15 16 21	1 S	14 W	Rancho La Brea			1		1			
			Totals	4	1	2	1	4	3	4	4

Reference to the above summary shows that drilling operations were commenced at four wells in this field during the past year. Oil in commercial quantities has not been obtained from any of these wells.

The proved area of this field has not been increased during the last year. The proved acreage for 1916–17, as shown by Table No. 1, is 1017 acres.

Following is a list of all decisions rendered covering operations in this field during the year ending June 30, 1917:

DECISIONS.

T. 1 S., R. 14 W., S. B. B. & M.

SECTION 20.

James F. Ross.

Well No. 3, drilling. CC-132.

Approved proposed estimated depth of shutting off water.

Well No. 3, shut-off. C-136.

Recommended pumping test of upper oil sand on account of a small rise in the water level while standing bailed for test.

Garbutt Oil Co.
Well No. 1, abandon. CC-331.
Approved proposal to abandon this well, indicating the depths at which shooting and plugging with cement should be done.
Well No. 3, abandon. CC-332.
Approved proposal to abandon this well, indicating the depths at which shooting and plugging with cement should be done.
Well No. 5, abandon. CC-334.
Approved proposal to abandon this well, indicating the depths at which shooting and plugging with cement should be done.
Well No. 11, abandon. CC-333.
Approved proposal to abandon this well, indicating the depths at which shooting and plugging with cement should be done.

SECTION 28.

E. A. Clampitt.
Well No. 1 (Melton), deepen. CC-329.
Approved proposal to deepen about 100 feet.
Well No. 2 (Melton), deepen. CC-328.
Approved proposal to deepen about 600 feet.

T. 1 S., R. 15 W., S. B. B. & M.

SECTION 25.

West Coast Oil Co.
Well No. 59, Wolfskill, redrill. CC-138.
Approved proposed depth for shutting of water. Recommended certain plugging if casing did not follow old hole.

REPORT ON MUDDING AND CEMENTING OPERATIONS AT RANCHO LA BREA OIL COMPANY WELL No. 41.

Sec. 15, T. 1 S., R. 14 W., S. B. B. & M., Salt Lake Field.

Along the line of development of the mudding process for excluding water from oil wells, which process has been used successfully, in numerous instances in California, the following mudding operation is described more or less in detail with the idea that other operators confronted with similar problems may profit by the experience of this company in attacking such problems when the more common method of putting in cement plugs has failed.

Rancho La Brea Oil Company Well No. 41 was completed in September, 1911, at a depth of 955 ft., and made an initial production of over 100 barrels of oil per day and no water. The production of this well dropped considerably from the initial production until January 24, 1916, on which date the company filed a proposal to deepen this well and cement a string of casing below the oil sands, in order to protect them from water, which they expected to develop at a depth of about 1800 ft., for use on the property.

Water sand was unexpectedly encountered at a depth of 1123′ and penetrated to a depth of 1285′. Drilling operations were stopped when this depth was reached and several attempts were made to plug the bottom of the well in order to protect the oil sands from water.

Various methods of bridging and cementing were employed by the company and by cement experts, but without success.*

In April, 1917, an official of the company called upon this department for advice relative to shutting off water in this well.

Detailed information regarding the physical condition of the well was requested from the company. A study of the records and an interview with the field superintendent of this company, Mr. F. J. Prehoda, brought out the fact that cement placed in the bottom of this well was carried back into the formation. This probably accounted for the failure of the various cementing jobs to shut off the water. The result of this interview was an agreement on the part of the company to pump mud-laden fluid into the sands near the bottom of the well. Mr. Prehoda, who has had considerable experience in the use of mud-laden fluid, was in active charge of the work and co-operated with the State Mining Bureau in every way looking toward the elimination of the water trouble which was fast spreading to adjoining wells on this and neighboring properties.

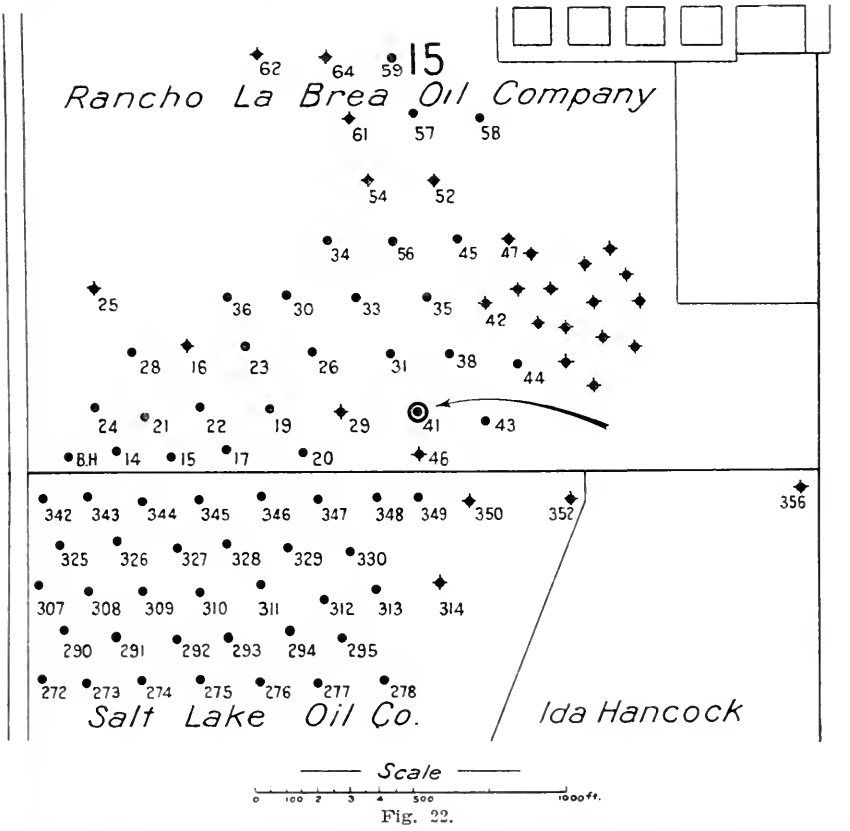


Fig. 22.

*In order that the history of operations at this well might be as complete as possible at the time of going to press, the work has been reported up to date. (Dec. 20, 1917.)

Previous to the beginning of mudding operations, the well had been bridged from bottom (1285′) up to 1100′ with bricks and rocks driven down by the tools.

On May 10, 1917, this bridge was drilled out to a depth of 1185′ and mudding operations started. The oil string was set at a depth of about 1100′, and mud about the consistency of rotary mud pumped into the well through 3″ tubing, which extended to a depth of 1168′. About 24 hours after mudding operations were started, Salt Lake Oil Company's wells Nos. 313, 329, 330, 347, 348 and 349, and Rancho La Brea Oil Company's well No. 38 pumped water carrying considerable mud. Well No. 313 of the Salt Lake Oil Company is one-quarter mile distant from Rancho La Brea Well No. 41.

A total of about 700 cu. yds. of adobe and 40 cu. yds. of sawdust were pumped into this well in the first operation. Thin mud was first pumped in, and as soon as it appeared in the adjoining wells mentioned, these wells were, upon request of this department, shut down during subsequent mudding operations. Several hundred cubic feet of adobe were put into the well without any apparent success, as it seemed that the mud was wasted back into the formation. Upon suggestion of this department, sawdust was introduced into the mud and a favorable effect immediately noticed, in that, shortly afterwards, June 21, circulation was obtained. After the well had been thoroughly mudded, the mud-laden fluid stood at the surface for several days. On August 1, 1917, the mud was washed out of the hole and the well was bridged from 1109′ to 1095′ by tamping rock into the formation. The rock was lowered into the well in four shells made of galvanized iron. The bottom of the well was then cemented with 50 sacks of cement pumped through tubing, bringing the top of the cement plug up to a depth of 1080′.

From a study of monthly production reports for Salt Lake Oil Company's wells Nos. 312, 313, 329, 330, 346, 347, 348 and 349, adjacent to Rancho La Brea well No. 41, upon which the plugging off of bottom water was completed about August 1, 1917, it will be noted that, for the month of August, wells 330, 347 and 348 showed a marked increase in the amount of oil produced, and a corresponding decrease in the amount of water produced, per day; well No. 330 producing about three times as much oil as formerly; well No. 347 nine times as much oil and one-half as much water; well No. 348 two and one-half times as much oil as formerly.

In April, 1917, the production of Salt Lake Oil Company's wells Nos. 329, 330, 347 and 348 was 573 barrels of oil and 4252 barrels of water. In August, the production of the same wells was 1912 barrels of oil and 1268 barrels of water.

Wells Nos. 38 and 43, on the Rancho La Brea Oil Company's property, probably were affected by water coming from well No. 41. After No. 41 had been mudded, No. 38 was started pumping, and jumped approximately 75 barrels of oil per day. Previous to this time the well pumped only water. Well No. 43, which had been idle for some time, because the production of the well previous to mudding operations at No. 41 was all water, was put on the pump and produced 25 barrels of oil and 100 barrels of water per day. This well has not produced any mud.

After the cement plug had been pumped into Rancho La Brea well No. 41, and the well had been allowed to stand for three weeks, the well was put on the pump and produced between 300 and 400 barrels of clear salty water per day. No mud used during mudding operations appeared in the well. The cement plug which had been put into the well was found in place, and the water which was entering the well was probably coming from formations above the top of the plug.

About one month after the cementing of well No. 41, water again broke into Rancho La Brea well No. 38. The well pumped nothing but water, and mudding operations were again started at well No. 41. During the second mudding operation, four feet of the cement plug in the bottom of the well were drilled out, five old bullropes cut into three-inch lengths and mixed with adobe; about 70 yds. of adobe and 10 yds. of sawdust were pumped into the well. Mud was pumped into the well under a pressure of about 400 pounds per square inch.

Coincident with the reappearance of water in Rancho La Brea wells Nos. 38 and 41, and subsequent to the conclusion of the first mudding operations at the latter well, water conditions at certain wells at the Salt Lake Oil Co., apparently underwent a change. Production reports for September and October indicate that well No. 347 returned to about its original production. Wells Nos. 348 and 330 still show some improvement over conditions previous to the repair work. On the other hand, well No. 329 shows an increase of 900% in the production of water with an increase of only 200% in the production of oil, indicating that possibly the water channel to No. 329 was not as thoroughly mudded as were the channels of Nos. 330, 347 and 348. Well No. 346 was apparently not affected by the repair work. The reports also indicate that well No. 349 was probably affected, although during August it showed a decrease in oil produced and a slight increase in water produced. These reports also indicate that, when the water channel to No. 329 and No. 330 broke open again, these wells took some of the water which formerly was pumped from No. 349. Wells Nos. 312 and 313 do not appear to have been noticeably affected.

The amount of oil produced by wells Nos. 329, 330, 348 and 349 has increased approximately 20 bbls, per day, or a total of 80 bbls. per day, since mudding operations were completed in Rancho La Brea No. 41.

The second mudding operation at Rancho La Brea well No. 41 was in progress from November 3 until December 4. A pressure of 400 pounds per square inch was maintained and, during the latter part of November, the well took mud very slowly.

During this time Rancho La Brea Oil Company well No. 38 was shut down. On December 11, when the pumps of well No. 41 were practically "stalled" and the well was taking only a small amount of mud, well No. 38 was put on the pump and began to pump muddy water. Well No. 41 immediately began to take more mud. For three days well No. 38 pumped muddy water, then started to pump a small amount of oil. On December 20 the well was pumping about 50 bbls. of oil per day and no water and mud fluid in well No. 41 stood at the surface.

As mentioned above, the production during April, 1917, for the Salt Lake Oil Company's wells Nos. 329, 330, 347 and 348 was 573 barrels of oil and 4252 barrels of water. In August the production of the same wells after the first mudding operation was 1912 barrels of oil and 1268 barrels of water.

During the second period of mudding operations at Rancho La Brea well No. 41, these wells, as shown by the November production report, produced 2483 barrels of oil and 4693 barrels of water. The amount of water is approximately the same as reported previous to the first mudding of well No. 41, but the quantity of oil has increased 500%.

A study of a cross section showing stratagraphic correlation of points of shut-off in the wells above noted, may throw further light on the reasons for the effects as noted from production reports in the various wells.

Following is a record of fluid levels in the Salt Lake Oil Company wells under discussion:

Fluid Levels From Surface.

Well No. 329	Feb. 16, 1917	1,920′	Aug. 25, 1917	700′	Nov. 1, 1917	900′
In December this well was pumping muddy water and oil.								
Well No. 330	May 11, 1917	603′	Oct. 11, 1917	700′		
Well No. 347	Mar. 13, 1917	800′	Sept. 24, 1917	720′	Dec. 7, 1917	680′
Well No. 348	May 24, 1917	380′	Aug. 22, 1917	500′	Dec. 7, 1917	760′
Well No. 328	June 23, 1917	650′	Sept. 13, 1917	1,180′	Dec. 7, 1917	1,287′
This well pumped sawdust on September 13, 1917.								

CONCLUSIONS.

One factor of great importance in the study of water conditions in this area, as shown by Table No. 1 printed below, is the presence of large quantities of water in certain wells of the Salt Lake Oil Company previous to the penetration of bottom water in Rancho La Brea well No. 41. This well entered bottom water February 23, 1916, and the production reports for wells of the Salt Lake Oil Company shown in the table for the month previous show as much water as the average monthly production for these wells since that time. The total production of oil, however, has been increased one-third for the same period, probably as a result of the mudding operations.

TABLE No. 1.

Monthly Production of Oil and Water, in Barrels, From Wells Adjacent to Rancho La Brea Oil Company Well No. 41.

Company	Well	January, 1916		February, 1917		June, 1917		November, 1917	
		Oil	Water	Oil	Water	Oil	Water	Oil	Water
Salt Lake	276	104	1,636	63	1,036	195	1,305	134	1,206
Salt Lake	312	370	1,171	370	1,171	285	1,615	140	1,260
Salt Lake	313	582	1,182	499	1,013	95	535	114	1,021
Salt Lake	329	389	53	329	45	0	50	630	770
Salt Lake	330	108	342	0	560	0	0	960	640
Salt Lake	346	278	42	245	43	238	10	276	24
Salt Lake	347	149	1,713	212	2,433	0	0	180	1,620
Salt Lake	348	240	197	0	2,025	0	0	713	1,633
Salt Lake	349	394	2,071	325	1,714	440	1,760	410	1,640
Totals		2,594	8,407	2,047	10,040	1,253	5,275	3,557	9,844

From the foregoing, the conclusion may be drawn that Rancho La Brea Oil Company well No. 41 was not the cause of the principal water trouble in adjoining Salt Lake wells. The mudding of this well undoubtedly has bettered the water conditions on the property of the Rancho La Brea Oil Company and has affected the oil production of certain Salt Lake Oil Company wells.

The main source of water trouble on the Salt Lake Oil Company's property in this area, however, antedates the deepening of Rancho La Brea well No. 41, and may later be found in one or more of the wells shown in Table No. 1, or possibly from a well in this vicinity which was drilled through the zone of bottom water and improperly abandoned.

The work of investigation of this condition will be continued and, as it involved a number of wells and not one well as formerly supposed, it may become necessary to construct models and make numerous cross sections before the actual source or sources of the water entering these wells can be determined.

The following tabulation gives the production of oil and water as shown by production reports in barrels per producing well per day of wells adjacent to Rancho La Brea Oil Company well No. 41:

TABLE No. 2.

Company	Well No.	February, 1917		June, 1917		November, 1917	
		Barrels oil	Barrels water	Barrels oil	Barrels water	Barrels oil	Barrels water
Salt Lake	276	3.5	54.5	7.3	49.0	6.1	53.9
Salt Lake	312	16.1	50.9	9.8	55.7	6.1	54.8
Salt Lake	313	20.8	42.2	9.5	53.5	6.3	56.7
Salt Lake	329	15.0	2.0	0	50.0	35.0	42.8
Salt Lake	330	0	31.1	Idle	Idle	34.3	22.9
Salt Lake	346	10.2	1.8	9.2	0.3	9.2	0.8
Salt Lake	347	7.9	90.1	Idle	Idle	6.9	62.3
Salt Lake	348	0	75.0	Idle	Idle	31.0	72.3
Salt Lake	349	13.6	71.4	16.9	67.7	15.2	60.7
Rancho La Brea	20	11.9	0.2	17.5	0.2	15.0	0.2
Rancho La Brea	26	4.4	0	5.4	0	5.2	0.1
Rancho La Brea	31	8.0	0.4	8.9	0.5	6.0	0.6
Rancho La Brea	35	5.0	5.0	5.4	5.4	5.2	5.2
Rancho La Brea	43	Idle	Idle	Idle	Idle	1.5	5.8
Rancho La Brea	44	Idle	Idle	Idle	Idle	Idle	Idle
Totals		116.4	424.6	89.9	282.3	182.0	429.1

NEWHALL FIELD.

GENERAL DESCRIPTION.

All of the developed area in and adjacent to the Santa Susana Mountains, from the Los Angeles-Ventura county line on the west to the region of Newhall and Fernando Pass on the east, is included in the general field name of Newhall. The principal developed areas in this field are situated in Pico, Dewitt, Towsley, Wiley and Rice Cañons, and in Fernando Pass; all of the foregoing on the north slope of the Santa Susana Mountains.

GEOLOGY.

For detailed report on the geology of this field, see U. S. Geological Survey Bulletin No. 309 and Bulletin No. 69 of the California State Mining Bureau.

The producing areas in Pico, Towsley, Wiley and Rice Cañons are confined within narrow limits, along the crest of a well-defined steep dipping anticline in the Vaqueros formation, which is developed on the north slope and parallel with the range of the Santa Susana Mountains. The cañons referred to cut through the anticline transversely and seepages of oil occur from exposed oil sands.

The anticlinal dome, from which production is obtained in Fernando Pass near Newhall, is not connected with structure upon which the other producing areas in this field are located.

Out of a total of about 200 wells drilled in this field, 75 are now producing. According to monthly production reports, this field produced a total of 10,851 bbls. of oil and 9,765 bbls. of water during the month of June, 1917. Reference to Table No. 1 shows that the average daily production in this field is about 5 bbls. of oil and 4 bbls. of water per producing well per day.

Study of map showing relative amounts of water produced by each well shows that there are a comparatively small number of wells in this field which produce clean oil, and that the production of water is fairly evenly distributed throughout the field, with the exception of one well in the eastern portion of this field, which produced about one-third of the total amount of water shown by monthly production reports for the entire field. The owners of this well have commenced drilling a second well, and propose to conduct certain tests to locate, if possible, the source of water entering the first well.

The gravity of the oil in the Elsmere Cañon district ranges from 14-17° Baumé. These wells are drilled in the Fernando formation. The gravity of oil produced in Wiley and Pico Cañons ranged from 25-56° Baumé, and production is probably obtained from the Vaqueros formation.

The following is a list of notices received and decisions rendered during the fiscal year:

Section	Township	Range	Company	New wells		Test of water shut off		Deepen or redrill		Abandon	
				Notices.	Decisions.	Notices.	Decisions.	Notices.	Decisions.	Notices.	Decisions.
6	3 N	15 W	Tunnel Pet.	1	1	1	1				
7	3 N	15 W	Standard	1	1	1	1			1	1
7	3 N	15 W	Dr. P. Bauer							1	1
16	3 N	16 W	Standard	2	2	5	6				
30	3 N	16 W	Placerita Oil			1	1			2	2
2	3 N	17 W	Standard			1	1				
			Totals	4	4	9	10			4	4

The following decisions have been made on proposed well operations:

DECISIONS.

T. 3 N., R. 15 W., S. B. B. & M.

SECTION 6.

Tunnel Petroleum Co.

Well No. 1, drill. CC-129.

Approved decision to commence drilling, prospecting for oil sand before shutting off water.

Well No. 1, shut-off. C-84.

Test of water shut-off approved.

SECTION 7.

Standard Oil Co.

Well No. 21, Elsmere, drill. CC-167.

There was not sufficient information available to indicate the exact depth at which water should be shut off. The proposal to drill this well and locate oil-bearing formations was considered satisfactory by this department.

Well No. 21, Elsmere, shut-off. C-124.

Test of water shut-off satisfactory.

Well No. 21, abandon. CC-224.

The company filed a proposal to abandon this well, stating that certain plugging had been done and tests made, and that, after this work had been done, the well produced 1 bbl. oil and 8 bbls. of water per day.

A study by this department of record of work done by the company showed that certain plugging was done in sand. Recommendations were made by this department to do certain plugging in shale. In carrying out work recommended, the water string was loosened after which the well produced an average of 25 bbls. of oil and 8 bbls. of water per day, indicating that productive formations had formerly been shut off.

Dr. Paul Bauer.

Well No. 2, Nettleton & Killerman, abandon. CC-190.

Approved proposal to abandon. Recommended certain shooting and plugging.

T. 3 N., R. 16 W., S. B. B. & M.

SECTION 16.

Standard Oil Co.

Well No. 26, Wiley, shut-off. C-83.

Test of water shut-off satisfactory.

Well No. 27, drill. CC-201.

Approved estimate of depth for water shut-off.

Well No. 27, Wiley, shut-off. C-156.

The results of the test indicate that 8¼" casing prevented water above the shut-off point from passing to the lower levels of the well. Approval to continue drilling was given.

Well No. 27, Wiley, shut-off. C-163.

After the well had been deepened below the original shut-off point, it was found necessary to make another shut-off. Test of this shut-off was approved.

Well No. 27, Wiley, shut-off. CC-273.

The company filed a notice stating that they believed water was encountered below the 6¼" casing. Approved proposal to loosen 6¼" casing and continue drilling, prospecting for oil sand.

Well No. 27, Wiley, shut-off. C-169.

Water was shut off with 6¼" casing and test of shut-off approved.

Well No. 28, Wiley, drill. CC-202.

Approved estimate of depth for shutting off water.

Well No. 28, Wiley, shut-off. C-162.

Test of water shut-off approved as satisfactory.

SECTION 30.

Placerita Oil Co.

Well No. 1, abandon. CC-178.

Approved proposal to abandon, indicating depths at which shooting and plugging should be done.

Well No. 2, shut-off. C-110.

Test of water shut-off satisfactory.

Well No. 2, abandon. CC-175.

Records show that oil or gas-bearing formations were not encountered in this well. Approved proposal to remove as much casing as possible. No plugging was required.

T. 3 S., R. 17 W., S. B. B. & M.

SECTION 2.

Standard Oil Co.

Well No. 41, PCO, shut-off. C-92.

Test of water shut-off satisfactory.

MISCELLANEOUS FIELDS.

Dominguez Field: During the past year four new wells were commenced in the vicinity of Long Beach and Compton, in the Dominguez and San Pedro ranchos on the southern extremity of the range of hills of generally low relief extending from Beverly Hills in the Salt Lake field to Signal Hill, Long Beach. The companies operating in this field are the Highland Development Co., the Standard Oil Co., the Union Oil Co., and the General Petroleum Corporation.

No detailed study of the geology of this region has been made by this department.

Inglewood Field: Toward the northern end of the low range of hills upon which the Dominguez field is situated and near the town of Inglewood, the Bartolo Oil Co. commenced drilling a well in August, 1916. Oil in commercial quantities has not been developed up to the present time. Drilling operations are still in progress.

San Fernando Valley: Active development work was not carried on in this field during the past year.

A well drilled by the Crafton Oil Co. in Sec. 1, T. 2 N., R. 15 W., S. B. B. & M., was abandoned and plugged by Mr. L. A. Clampitt.

D. W. Griffith Well No. 1, Section 36, T. 3 N., R. 15 W. This well was drilled to a depth of about 1650′ and abandoned during the month of July, 1916.

Following is a summary of notices received and decisions rendered during the past year, also a list of decisions giving a brief statement relative to work done at each well.

Section	Township	Range	Company	New wells		Test of water shut off		Deepen or redrill		Abandon	
				Notices	Decisions	Notices	Decisions	Notices	Decisions	Notices	Decisions
11	3 S	8 W	F. H. Rowley							1	1
14	11 N	12 W	Mojave Oil							1	1
----	1 S	13 W	I. H. Preston	1							
----	6 S	10 W	W. S. Collins							1	1
----	2 S	10 W	Pet. Dev. Co. (Sentous Rch.)	1	1						
			Dominguez Field—								
19	4 S	12 W	Union Oil	1	1						
----	4 S	13 W	Standard	1	1	1	1	1	2		
----	4 S	13 W	Highland Dev.		1	3		1			
----	4 S	13 W	Gen. Pet.	1	1						
			Inglewood Field—								
20	2 S	14 W	Bartolo Oil	1	1		1		1		
			San Fernando Field—								
1	2 N	15 W	Crafton Oil							1	1
1	2 N	15 W	L. A. Clampitt								1
36	3 N	15 W	D. W. Griffith							1	1
			Totals	6	6	4	2	2	3	5	6

DECISIONS.

T. 3 S., R. 8 W., S. B. B. & M.

SECTION 11.

F. H. Rowley.

Well No. 1, abandon. CC-215.

Records filed with this department state that no oil or gas sands were encountered in the well. Approval was given to pull out all casing obtainable. No plugging was required.

T. 2 S., R. 10 W., S. B. B. & M.

Sentous Ranch.

Petroleum Development Co.

Well No. 1, drilling. CC-322.

Recommend that company cement each string of casing landed below 12½" casing.

T. 6 S., R. 10 W., S. B. B. & M.

Irvine Ranch.

W. S. Collins.

Well No. 3, abandon. CC-307.

The work of abandoning was practically completed before "Notice of Intention to Abandon" was filed. Plugging done probably protected the oil-bearing formations from water.

T. 11 N., R. 12 W., S. B. B. & M.

SECTION 14.

Mojave Oil Co.

Well No. 1, abandon. CC-161.

Approved proposal to pull all casing obtainable. According to the log of the well filed, no oil or gas-bearing formations were encountered. Plugging was not required.

T. 4 S., R. 12 W., S. B. B. & M.

SECTION 19.

Union Oil Co.

Well No. 1, Bixby, drill. CC-189.

Recommended that the company cement each string of casing landed. There was no data at hand to show the exact depth at which water should be shut off or the depth at which formations which may contain oil would be encountered.

T. 4 S., R. 13 W., S. B. B. & M.

Rancho San Pedro.

Standard Oil Co.

Well No. 1, Dominguez, drill. CC-153.

Recommended that company cement each string of casing landed in this well in order to be in better position to locate any oil-bearing formations which may be penetrated.

Well No. 1, Dominguez, shut-off. C-120.

Results of test showed that water was not completely shut off. Recommended that company continue drilling and shut off when more favorable formations were encountered.

Well No. 1, Dominguez, redrill. CC-234.

Notice of redrilling received from the company stated that, on account of shifting sand, it was necessary to move the rig and start a new hole and that certain shooting and plugging had been done in the original hole. A representa-

tive of the company stated that the showing of oil recorded in the log evidently came from the mud used in drilling and that this mud was hauled from another property. Recommended that the company file additional records relative to the showing of oil recorded in the log.

Well No. 1, Dominguez, redrill. CC-304.

The log of the second hole drilled, near the first one, substantiated the theory advanced by the company relative to the showing of oil recorded in the original hole, and the records were cleared by this decision (Co. CC-304), in which it was stated that the work done at the original hole was accepted by this department as satisfactory. At the present time drilling is being continued in the second hole.

Highland Development Co.

Well No. 1, Dominguez, continue drilling. CC-330.

An attempt which was made to make a formation shut-off with 8¼" failed to shut off water. Approved proposal to continue drilling, prospecting for an oil sand, with 6¼" casing.

General Petroleum Corp.

Well No. 1, Dominguez, drill. CC-193.

Approved proposed plan of cementing 12½" casing and other casing when found necessary.

Well No. 1, commence drilling. CC-133.

Approved proposal to commence drilling. The notice of intention to commence drilling stated that water should be shut off at about 2000'. No recommendation relative to depth at which water should be shut off was made on account of this being a prospect well.

T. 2 S., R. 14 W., S. B. B. & M.

SECTION 20.

Bartolo Oil Co.

Well No. 1, shut-off. C-128.

Test of water shut-off with 12½" casing approved.

Well No. 1, deepen and recement. CC-290.

The 8¼" casing which was cemented failed to shut off water. Approved proposal to deepen, prospecting for oil-bearing formations.

T. 2 N., R. 15 W., S. B. B. & M.

SECTION 1.

Crafton Oil Co.

Well No. 1, abandon. CC-197.

Approved proposal to abandon. Recommended shooting and certain plugging with cement. Required affidavits giving names and addresses of all workmen engaged in abandoning the well, and record of work done in abandoning.

L. A. Clampitt.

Well No. 1, Crafton, abandon. CC-225.

L. A. Clampitt purchased the equipment at Crafton Well No. 1. Approved proposal to remove certain casing and conduct tests for determining the amount of oil which this well would produce. Affidavit was furnished, giving record of work done in abandoning this well, according to our decision CC-197.

T. 3 N., R. 15 W., S. B. B. & M.

SECTION 36.

David W. Griffith.

Well No. 1, abandon. CC-126.

Certain work at this well previous to abandonment was not done in compliance with the law governing such work.

This well was abandoned before the log record had been filed and before this department had had an opportunity to make an investigation. Log records filed subsequent to completion of abandonment work, showed that oil-bearing formations were not encountered in this well.

VENTURA COUNTY.

DISTRICT No. 2.

Previous publications of the State Mining Bureau have described in detail the pioneer days of the oil industry in the Ventura oil district, together with general descriptions of the geology of these districts and the developments up to and including the year 1916. For such detailed description, reference may be made to Geology of California, Vol. II, 1882, by Peckham, California State Mining Bureau Bulletin 11 by Watts, U. S. Geol. Survey Bulletin No. 309, covered by Eldredge, California State Mining Bureau Bulletin No. 63 by Prutzman, and California State Mining Bureau Bulletin No. 69 by McLaughlin.

The intense folding and faulting which has disturbed this region is responsible for the scattering of oil deposits into so many parts of the territory. In no other district of the state is production obtained from so many minor folds and from so many geologic horizons as in the districts under discussion. All geologic formations present in this region from the Tejon, or upper Eocene, to the Fernando, of Pliocene age, are petroliferous and contain oil horizons which are productive in the different fields, where penetrated.

Ventura County has been divided into eight separate fields for mapping and descriptive purposes, and the features characterizing this classification are mainly topographic features. The names of the fields have been supplied and are in general use by the oil operators in Ventura County.

The number of wells in this district, number of producing wells, number of logs filed, number of graphic logs, average daily production of oil and water, percentage of water, number of acres of proved oil land, average daily amount of oil produced per acre during June, are shown by fields in the following tabulation:

TABLE No. 3.

Field	Wells listed	Logs filed	Graphic logs	Number wells accounted for by production reports	Number wells actually producing according to production reports	Average daily production		Average daily production per producing well		Percentage of water	Proved oil land	
						Barrels oil	Barrels water	Barrels oil	Barrels water		Acreage	Average daily production per acre
Simi	38	23	0	20	20	197	19	9.8	1	8.8	138	1.4
Piru	167	16	0	71	70	370	462	5.3	6.6	56.2	427	.86
Bardsdale	156	136	13	128	126	1,657	165	13.1	1.3	9.1	280	5.92
Sespe	131	44	0	29	29	108	93	3.7	3.2	46.3	239	.45
South Mountain	9	8	0	4	4	134	0.4	33.5	0.1	0.3	40	3.35
Santa Paula	131	7	0	45	34	104	46	3.1	1.4	30.5	100	1.04
Ojai	119	29	0	62	59	146	29	2.5	0.5	16.6	297	.49
Ventura	6	6	6	1	1	12	240	12	240	95.4	10	1.2
Totals	757	260	19	360	343	2,728	1,054.4	7.9	3.1	27.9	1,531	1.7

The following table gives a summary of written notices received and decisions made in this district during the past year.

TABLE No. 4.

Field	New wells		Test of water shut off		Deepen or redrill		Abandon	
	Notices	Decisions	Notices	Decisions	Notices	Decisions	Notices	Decisions
Simi			1	2	1	1	2	2
Piru	1	5	2	2				
Bardsdale	9	10	29	23	6	4	3	3
Sespe	3	2					3	3
South Mountain	9	9	13	6	1	1	1	1
Santa Paula	4	4	1	1	1	1	2	2
Ojai	3	4	2	2	2	2		
Ventura	9	9	2	3	1	3	2	2
Miscellaneous						1		
Tota's	38	43	50	39	12	13	13	13

SIMI FIELD.

The territory mapped as the Simi Field includes the valley of Simi, together with the slopes of the Santa Susana and Simi ranges, which flank the valley on all sides. It is bounded on the east by the Los Angeles-Ventura county boundary line, and includes the major portions of Townships 2 and 3 North, Ranges 17 W., 18 W., and 19 W., S. B. B. & M. The Simi field may further be extended, if warranted by future developments, to include the valley of Moorpark and Somis, lying to the west and a natural extension of the Simi Valley.

PRODUCTION AND WATER CONDITIONS.

The production of the twenty producing wells in this field for the month of June, 1917, amounted to about 5,919 bbls. of oil and 580 bbls. of water, or a daily average of 197 bbls. of oil and 19 bbls. of water per well per day.

The proved oil land in this field amounts to about 138 acres. Recent drilling operations begun by the Doheny-Pacific Petroleum Company may increase the area of proved land materially during the coming year.

Summary of notices received and list of decisions rendered during the fiscal year follows:

Section	Township	Range	Company	New wells		Test of water shut off		Deepen or redrill		Abandon	
				Notices	Decisions	Notices	Decisions	Notices	Decisions	Notices	Decisions
36	3 N	18 W	Doheny-Pac. (Petrol Co.)			1	2	1	1		
36	3 N	18 W	Midway Simi							1	1
33	3 N	18 W	Cal. Profit Sharing							1	1
			Totals			1	2	1	1	2	2

Following is a list of all decisions rendered covering operations at wells in this field for the past year, accompanied by brief descriptions showing the character of work done at each well included in the list and recommendations made by this department.

DECISIONS.

T. 3 N., R. 18 W., S. B. B. & M.

SECTION 36.

Doheny-Pacific Petroleum Co.

Well No. 3 (Petrol), deepen. Letter 8/3/16.

Approved proposal to deepen, prospecting for lower oil-bearing formations.

Well No. 3, shut-off. C-179.

The results of the test showed that water encountered near the bottom of the well had been successfully plugged off.

Well No. 15, shut-off. C-115.

Test of water shut-off approved.

Midway Simi Oil Co.

Well No. 1, abandon. CC-140.

Approved proposal to abandon. Recommended that shooting and plugging be done between certain specified depths.

T. 3. N., R. 19 W., S. B. B. & M.

SECTION 33.

California Profit Sharing Oil Co.

Letter Nov. 24, 1916.

Certain casing was removed from the well before this department had an opportunity to issue a decision and before the time for issuance of such decision had expired. Mr. C. W. Fox, Trustee, filed an affidavit relative to the sale of certain casing to Mr. E. A. Clampitt. An investigation of the case was made by the supervisor which showed that the well was left in such condition as to not damage surrounding territory by flooding oil sands with water.

PIRU FIELD.

The Piru Field takes its name from the town of Piru, which is located in the Santa Clara Valley on a coast line branch of the Southern Pacific Railroad. This field includes all development lying in and adjacent to Torrey, Eureka, Tapo and Hopper Cañons, and Piru Creek, in which region also are those portions of the Ranchos San Francisco and Temescal, lying in Ventura County. The field is bounded on the east by the Los Angeles-Ventura county line and on the west by a north and south line drawn from the northwest corner of Section 2, T. 5 N., R. 19 W., to the Santa Clara River on the west line of Section 35, T. 4 N., R. 19 W.

The production in this field is obtained mainly from Miocene formation of Vaqueros and Monterey ages, and the structure is complicated by intense folding along east and west lines. Producing wells are confined to the apices and flanks of the steep dipping anticlines as exposed in the cañons cutting across them, and is terminated to the west by the north-south fault which forms the drainage basin of Hopper Cañon.

PRODUCTION.

Reference to Table No. 3 shows that there were 70 producing wells in this field during June, 1917, with an average daily production of 370 bbls. of oil and 462 bbls. of water for the field, or an average of 5.3 bbls. of oil and 6.6 bbls. of water per producing well per day. One group of 7 wells in this field produced 205 out of 462 bbls. average daily production of water for the entire field.

The water conditions in certain portions of this field are serious. A number of wells are now idle because the cost of lifting the water produced by these wells does not allow for a profitable operation of the wells.

It seems advisable and necessary to plug and abandon some of these wells in order to protect the territory from water. In some cases the amount of salvaged material would more than pay for the cost of necessary plugging.

Active drilling operations were carried on at three wells in Eureka Cañon, Section 34, T. 4 N., R. 18 W., without developing oil in paying quantities.

The following summary of notices received and decisions rendered during the fiscal year shows that there has been little activity in new development during the fiscal year.

List of official decisions giving a statement relative to recommendations made by this department is also given.

Section	Township	Range	Company	New wells		Test of water shut off		Deepen or redrill		Abandon	
				Notices.	Decisions.	Notices.	Decisions.	Notices.	Decisions.	Notices.	Decisions.
33	4 N	18 W	Winnipeg			1	1				
34	4 N	18 W	Eureka Canon Syndicate		4	1	1				
13	4 N	19 W	Ventura Pac.	1	1						
			Totals	1	5	2	2				

DECISIONS.

T. 4 N., R. 18 W., S. B. B. & M.

SECTION 8.

Diamond Valley Oil Co.

Well No. 4, commence drilling. CC-243.

Approved proposed depth for shutting off water.

SECTION 33.

Winnipeg Oil Co.

Well No. 3, shut-off. C-130.

The results of test of water shut-off were satisfactory. Recommend that well be put on pump for 90 days for further test.

SECTION 34.

Eureka Canon Syndicate.

Well No. 2, shut-off. C-66.

Test of water shut-off approved.

Well No. 3, test water string. CC-166.

When testing water shut off the well was drilled 17′ below the water string and water rose to within 100′ of the surface. Recommended that company test water string by bridging below it with cement.

Well No. 3, make production test. CC-217.

After failing to shut off water with the 6¼″ casing, this casing was shot off and the 8¼″ casing loosened and cemented at 1169′, and failed to shut off water. Approved proposal to put in 6¼″ casing and make a pumping test. The results of this test indicated that water was probably entering the well below the shut-off point.

Well No. 3, re-cement. CC-238.

Approved proposal to cement 6¼″ casing at a depth of about 1250′.

T. 4 N., R. 19 W., S. B. B. & M.

SECTION 13.

Ventura-Pacific Oil Co.

Well No. 6, drill. CC-302.

There was not sufficient information available at the time this decision was written to indicate the depth at which water should be shut off. The company did not file further information, possibly on account of same not being available.

BARDSDALE FIELD.

The limits of this field are defined by a recent classification of the State Mining Bureau as the Santa Clara River on the north, the crest of Oak Ridge on the south, and from Sulphur Cañon on the west to the township line between Ranges 18 and 19 W. on the east. It includes the following active operating oil companies: Montebello, Calumet and Home Ranch Petroleum, John Barneson, Union Oil, Bardsdale Crude and West Huasna and Bell Oil companies.

GENERAL GEOLOGY.

According to previous publications of the State Mining Bureau, Oak Ridge, the prominent topographic feature of the field, represents a portion of the south flank of an anticline which parallels and lies immediately south of the Santa Clara Valley, trending nearly east and west. The southern flank of Oak Ridge and of the anticline dips uniformly under the Simi Valley and the northern slope of the anticline is almost completely buried and masked under the low range of hills on the south side of Santa Clara Valley. The formations exposed on the surface in this field include beds of Sespe, Vaqueros and Monterey age.

Sections 3 and 4, T. 3 S., R. 19 W.: Wells drilled on the property of the Montebello, Calumet and Home Ranch Petroleum companies in Sections 3 and 4, T. 3 S., R. 19 W., penetrate and produce from the Sespe and possibly Tejon formations. Three well-defined oil zones have been encountered on the property of the Montebello Oil Co., and two on the Calumet and Home Ranch Petroleum companies, the first zone being unproductive on the latter properties.

Two well-defined zones carrying salt water have also been penetrated on these properties. The first water zone lies between the first and second oil zones, and the lower salt water lies between the second and third oil zones.

PRODUCTION AND WATER CONDITIONS.

Log records and monthly reports of wells drilled in Sections 3 and 4, T. 3 S., R. 19 W., show that there were 68 wells which obtained production from the first oil zone only. These wells averaged about 5 bbls. of oil and 1.6 bbls. of water per day.

Twenty-one wells obtained production from the second zone only, and averaged about 60 bbls. of oil and 2.3 bbls. of water per day during the month of June, 1917.

The first well was completed at a depth of 650′, in April 1911, and produced from the first zone only. The first well producing from the second zone was completed in June, 1914, at a depth of about 1800′, and is located in the east half of Section 4.

The first zone has been protected in this field throughout its productive area. This was done by shutting off water above this zone and below this zone above the intermediate salt water between the first and second zones, by wells penetrating the second zone. In the latter wells another shut-off was made below the intermediate water between these zones and above the second oil zone. This necessitated the use of three water strings by wells producing from the second zone.

Water below the second oil zone was encountered in seven wells and successfully plugged off.

The third oil zone in this area has only recently been encountered in drilling, and the importance of this zone for production has not been demonstrated. The gravity of oil in this zone is about 37° Baumé. This zone underlies the salt water below the second oil zone.

A study of production reports received from companies operating in this area shows that the care exercised by operators in the matter of protecting oil bearing formations from water has resulted in a small production of water per well. The employment of scientific methods in the study of the underground structure by one of the large companies (Montebello Oil Co.) in this area, which included the construction of a peg model and cross-sections of wells on their property, no doubt has aided in the efficient development of this property.

Sections 6 and 7, T. 3 S., R. 19 W., and Sections 1 and 12, T. 3 S., R. 20 W.: This area embraces development in and adjacent to Grimes Cañon.

Monthly production reports filed with this department for the month of June, 1917, show 34 producing wells for this area. These reports have been received from all operators except the Bell Oil Company. The total monthly production shown by these reports for June amounted to about 2,000 bbls. of oil and 151 bbls. of water. It is interesting to note that a number of wells were drilled 20 to 25 years ago and are still producing a small quantity of oil. The gravity of the oil produced averages 27° Baumé.

Following is a summary of notices received and decisions rendered:

Section	Township	Range	Company	New wells		Test of water shut off		Deepen or redrill		Abandon	
				Notices	Decisions	Notices	Decisions	Notices	Decisions	Notices	Decisions
3	3 N	19 W	Home Ranch Petr. Co.	1	1		1				
3	3 N	19 W	Calumet Oil	1	1		1	1	1		
4	3 N	19 W	Montebello	5	6	28	19	3	2	2	2
5	3 N	19 W	Montebello	1	1	1	1				
7	3 N	19 W	John Barneson				1	1		1	1
12	3 N	20 W	Bardsdale Cr.					1	1		
12	3 N	20 W	Union Oil	1	1						
			Totals	9	10	29	23	6	4	3	3

Official decisions were made for wells in this field as follows:

DECISIONS.

T. 3 N., R. 19 W., S. B. B. & M.

SECTION 3.

Calumet Oil Co.

Well No. 2, deepen. CC-226.

The notice of intention to deepen stated that the well was free from water. Approved proposal to deepen.

Well No. 7, shut off. C-178.

A formation shut-off was made with 10" casing. Production test after well was completed indicated that water from above the shut-off point was not passing to lower levels in the well. Shut-off test satisfactory.

Well No. 9, drill. CC-284.

Approved proposed depth for shutting off water.

Home Ranch Petroleum Co.

Well No. 1, drill. CC-191.

The company proposed to shut off water at a depth of 250'. This department recommended that water be shut off at a depth of about 1250'.

Well No. 1, shut off. C-145.

Water was shut off at a depth of 1213' and test of shut-off approved.

T. 3 N., R. 19 W., S. B. B. & M.

SECTION 4.

Montebello Oil Co.

Well No. 102., shut-off. C-126.

Test of water shut-off for the 10" casing cemented at a depth of 1173' approved as satisfactory.

Well No. 109, Shiels, shut-off. C-119.

15½" casing cemented at a depth of 536'. Salt water plugged off in bottom of hole. Test of water shut-off approved as satisfactory.

Well No. 109, shut-off. C-134.

Test of water shut-off for the 12½" casing approved as satisfactory.

Well No. 113, drill. CC-125.

Approved proposal of the company to shut off water at a depth of about 600'.

Well No. 113, shut-off. C-103.

Approved test of water shut-off for 15½" casing cemented at a depth of 359'.

Well No. 113, shut-off. C-140.

Approved test of water shut-off for the 12½" casing.

Well No. 114, drill. CC-320.

Approved proposal to shut-off water at a depth of about 350'.

Well No. 98, shut-off. C-75.

Test of water shut-off for the 15½" casing approved as satisfactory.

Well No. 98, shut-off. C-86.

Test of water shut-off for the 12½" casing approved as satisfactory.

Well No. 98, shut-off. C-102.

Test of water shut-off for the 10" casing approved as satisfactory.

Well No. 101, drill. CC-319.

Approved proposal of the company to shut off water at a depth of about 300'.

Well No. 102, drill. CC-124.

Approved proposal of the company to shut off water at a depth of about 1000'.

Well No. 102, shut-off. C-93.

Test of water shut-off for the 12½" casing cemented at a depth of 1000' approved as satisfactory.

Montebello Oil Co.

Well No. 88, abandon. CC-281.

The hole was crooked and well abandoned Oct. 28, 1915, by plugging with cement at depths of 645, 410 and 370'. The work of abandoning was not done under the supervision of this department, but the cement plugs are probably effective. Record of work done was furnished by the company in order to complete the files of this department.

Well No. 89, shut-off. C-63.

Test of water shut-off with 12½" casing approved as satisfactory.

Well No. 90, abandon. CC-115.

Approved proposal of the company to abandon this well, due to twisting off of drill pipe. Proposed shooting and plugging at certain depths and moving the rig about 40' to redrill with rotary outfit, was also approved.

Well No. 97, shut-off. C-175.

A production test was witnessed at this well for the reason that notice of test of water shut-off had not been received by this department for the 8¼" casing, before the well was completed. The results of production test indicated that water from above a depth of 2291' is not passing to lower levels in the well.

Well No. 85, shut-off. C-85.

Test of water shut-off approved as satisfactory.

Well No. 85-A, shut-off. C-112.

Approved test of water shut-off for 10" casing cemented at 1182'.

Well No. 85-A, shut-off. C-177.

Production test witnessed by this department showed that water was successfully plugged off from entering at the bottom of the well and that the 10" water string excluded water from above a depth of 1182'. Test approved as satisfactory.

Well No. 87, drill. CC-250.

Approved the company's proposal to shut off water at a depth of about 350'.

Well No. 87, shut-off. C-160.

Test showed that water was not entering the well from above a depth of 338'.

Well No. 87, re-cement. CC-287.

Approved proposal of the company to cement the 12½" casing at a depth of about 550' using sufficient cement to extend from the bottom of the hole to the surface to protect an upper oil zone which was found to contain water.

Well No. 25, shut-off. C-71.

The results of the test indicated that water which entered the well from the bottom had been successfully shut off.

Well No. 55, redrill. CC-260.

Approved proposal to take out a portion of the oil string which was plugged with bailer and tools.

Well No. 77, deepen. CC-280.

The company filed notice of deepening this well after the work had been completed. This was done in order to complete the files.

Well No. 77, shut-off. C-176.

The results of test showed that water above the last cementing point was not passing to lower levels in the well. Test approved.

Well No. 81, shut-off. C-114.

Test of water shut-off satisfactory.

Well No. 85, shut-off. C-96.

Test of water shut-off approved as satisfactory.

SECTION 5.

Montebello Oil Co.

Well No. 1, Elkins, drill. CC-246.

Approved proposed depth for shutting off water. This is a prospect well and there was not sufficient information available to indicate the exact depth at which water should be shut off.

Well No. 1, Elkins, shut-off. C-188.

Water was shut off at about the depth planned by the company and test of shut-off approved.

SECTION 7.

Barneson et al.

Well No. 1, Ventura Lease, shut-off. C-90.

The results of the test did not definitely show that all water was shut off. Recommended that the company proceed with drilling and make another shut-off at a lower depth, if necessary.

John Barneson.

Well No. 1 (Boston Sonora), abandon. CC-275.

Approved proposal to remove casing and shoot and plug with cement between certain depths. Record of work done in abandoning has not been filed with this department.

T. 3 N., R. 20 W., S. B. B. & M.

SECTION 12.

Union Oil Co.

Well No. 15, drill. CC-163.

Data at hand did not furnish sufficient information as to the depth at which water-bearing formations should be encountered. Notice stated that this well was to be a test well and that the depth to water was unknown. Recommended that the well be drilled in such a manner as to protect from water, oil-bearing formations from which adjoining wells are producing.

Bardsdale Crude Oil Co.

Well No. 5, deepen. CC-181.

SESPE FIELD.

This field includes most of the territory drained by the Sespe Creek and its tributaries among which are Pine Creek, Coldwater Cañon, Tar Creek, Fourfork Creek, Centennial Creek, Little Sespe Creek, and also the region comprising the draining of Pole Cañon. The Sespe field adjoins the Piru field on the west. The Santa Clara River is its southern boundary. It includes all of T. 5 N., R. 20 W., the easterly $\frac{2}{3}$ of T. 4 N., R. 20 W., and the westerly $\frac{2}{3}$ of T. 4 N., R. 19 W., and T. 5 N., R. 19 W.

GENERAL GEOLOGY.

The structure of the Sespe Field is probably as complex as any structure with which oil production is associated in Ventura County. In general, the structure is of the fault block type, the formation having been faulted up in a north-south direction along a line which is followed roughly by the Big Sespe Creek, the strata dipping away from the fault zone east and southeast of Hopper Cañon, where the block faulting is duplicated. Consequently, the beds exposed by erosion in an east-west section through the middle of the field represent successive formations of Sespe to Puente ages. This fault block is complicated by highly compressed folding in the northwest-southeast direction.

Production is obtained mainly from oil sands of Sespe and Vaqueros formations, and followed lines of seepage from these formations, being influenced primarily by the position of transverse folds and the general eastward dip of the formations.

PRODUCTION AND WATER CONDITIONS.

The production obtained from this field is of relatively small importance at the present time. Reference to Table No. 3 shows that 131 wells have been drilled in this field, of which only 29 were producing in June, 1917. These wells average about 4 bbls. of oil and 3 bbls. of water per day each, during this month.

Some of these wells have been producing for nearly 30 years.

During the past year 2 new wells were drilled and 3 old wells abandoned, as shown by the following tabulation:

Section	Township	Range	Company	New wells		Test of water shut off		Deepen or redrill		Abandon	
				Notices.	Decisions.	Notices.	Decisions.	Notices.	Decisions.	Notices.	Decisions.
19	4 N	19 W	Gr. Rep. Oil & Paint Co.							1	1
33	5 N	19 W	White Star	1	1					1	1
1	4 N	20 W	Kentuck Oil	1	1						
19	5 N	20 W	J. C. Anderson							1	1
			Totals	2	2					3	3

Record of official decisions follow herewith:

DECISIONS.

T. 4 N., R. 19 W., S. B. B. & M.

SECTION 19.

Great Republic Oil & Paint Co.

Well No. 1, abandon. CC-274.

The original log of this well was lost. The information filed by the company was indefinite and conflicting. Recommended plugging with cement between certain depths.

T. 5 N., R. 19 W., S. B. B. & M.

SECTION 33.

White Star Oil Co.

Well No. 15, abandon. CC-264.

Notice of intention to abandon this well was received on *April 11, 1917*, and the work of abandonment had been completed on *April 9, 1917*. This work was not done under the supervision of this department and future developments may indicate that this well was not properly plugged.

Well No. 16, drill. CC-240.

Approved proposal of the company to shut off water at a depth of about 600'.

T. 4 N., R. 20 W., S. B. B. & M.

SECTION 1.

Kentuck Oil Co.

Well No. 7, drill. CC-340.

Approved proposal of the company to shut off water at a depth of about 100'.

T. 5 N., R. 20 W., S. B. B. & M.

SECTION 19.

J. C. Anderson.

Well No. 1, abandon. CC-139.

Recommended that if the 10″ casing was removed the hole be plugged with cement.

SOUTH MOUNTAIN FIELD.

GENERAL DESCRIPTION.

The South Mountain field is located on the south side of the Santa Clara Valley, taking in the mountain range known as South Mountain, and extending from Sulphur Cañon and the Bardsdale field, on the east, to the subsidence of the range under the Santa Clara Valley to the west.

The geology of this region has been described in Bulletin No. 309 of the U. S. Geological Survey and in California State Mining Bulletin No. 69. The structure of the present developed area in this field is anticlinal. The present producing wells are located near the apex of this anticline, and penetrate formations of probable Vaqueros and Sespe age.

HISTORY OF DEVELOPMENT.

The United Oil Company commenced drilling the first well in this field on November 4, 1915. This well was located in the S.E. ¼ of Section 17, T. 3 N., R. 20 W., and was drilled to a depth of 3800′, and, according to the log record, no oil-bearing formations were encountered. The well was abandoned in June, 1917.

Drilling was commenced at the second well by the Santa Paula Oil Association in June, 1916, and completed at a depth of 732′ on July 24, 1916. This well is located near the center of the north line of the S. W. ¼ of Section 18, T. 3 N., R. 20 W., S. B. B. & M. Productive oil sands were encountered in this well at a depth of 480′. By June, 1917, there were four wells completed and producing in this field. Various oil sands have been penetrated between depths of about 500′ and 3000′. During the fiscal year notices of intention to commence drilling nine wells were received. Drilling operations in this field were confined to Sections 17 and 18, T. 3 N., R. 20 W., and Section 13, T. 3 N., R. 21 W., and were carried on by the United Oil Co., Santa Paula Oil Co., and the Oak Ridge Oil Co.

PRODUCTION AND WATER CONDITIONS.

Reference to Table No. 3, shows that there were 4 producing wells, making an average of 33.5 bbls. of oil and .1 bbl. of water per well per day during the month of June, 1917. The oil produced by these wells averaged about 26° Baumé. Water has been effectively excluded in each of these wells.

FUTURE DEVELOPMENTS.

The recent increase in production in this field has resulted from the deepening of wells which formerly produced from an upper oil horizon. The production of wells producing from the lower horizon may probably be increased by further deepening.

Present developments indicate that the proved area of this field will be extended by the drilling of new wells.

The following summary shows the area in which active developments were carried on in the past year in this field:

Section	Township	Range	Company	New wells		Test of water shut off		Deepen or redrill		Abandon	
				Notices.	Decisions.	Notices.	Decisions.	Notices.	Decisions.	Notices.	Decisions.
17	3 N	20 W	United Oil	1	1	2	1	------	------	1	1
18	3 N	20 W	Santa Paula Oil Assn.	1	1	2	1	1	1	------	------
18	3 N	20 W	Oak Ridge Oil	5	5	4	1	------	------	------	------
13	3 N	21 W	Oak Ridge Oil	2	2	5	3	------	------	------	------
			Totals	9	9	13	6	1	1	1	1

A list of decisions relative to operations at various wells is given below:

DECISIONS.

T. 3 N., R. 20 W., S. B. B. & M.

Section 17.

United Oil Co.

Well No. 1, shut-off. C-152.

Test of water shut-off for 6¼" casing cemented at a depth of 3093' approved as satisfactory.

Well No. 1, drill. CC-218.

Study of data at hand did not indicate the exact depth at which water should be shut off. The notice stated that the company did not know the depth at which water should be shut off. Recommended that the question of shut-off be taken up before landing a string of casing for water shut-off.

Well No. 1, abandon. CC-308.

Records filed with this department do not show any oil or gas-bearing formations to have been encountered in this well. Approved proposal to plug the well between certain depths and remove as much casing as possible.

Section 18.

Oak Ridge Oil Co.

Well No. 1, Willard, drill. CC-131.

Approved proposal of the company to shut off water at a depth of about 500'.

Well No. 2, Willard, drill. CC-220.

Approved proposal of the company to shut off water at a depth of about 600'.

Well No. 2, Willard, shut-off. C-167.

Test of water shut-off for the 10" casing approved as satisfactory.

Well No. 3, Willard, drill. CC-219.

The proposal of the company to shut off water at a depth of about 510' approved as satisfactory.

Well No. 5, Willard, drill. CC-259.

Approved proposal of the company to shut off water at a depth of about 500'.

Well No. 4, Willard, drill. CC-258.

The proposal to shut off water at a depth of about 500' was approved.

Santa Paula Oil Association.

Well No. 2, drill. CC-130.

Approved proposal of the company to shut off water at a depath of about 700'.

Well No. 2, shut-off. C-170.

The failure of the company to file notice for test of water shut-off before the well was completed and producing from the first oil zone, necessitated a production test at this well. A production test was witnessed and approved.

Well No. 1, deepen. CC-291.

Approved proposal to deepen the well to increase production.

T. 3 N., R. 21 W., S. B. B. & M.

SECTION 13.

Oak Ridge Oil Co.

Well No. 1, shut-off. C-111.

Test of water shut-off for 12½" casing approved.

Well No. 1, Harvey, drill. CC-237.

Approved a proposal of the company to shut off water at a depth of about 350'.

Well No. 1 Y.R., shut-off. C-78.

Approved test of water shut-off with the 15½" casing.

Well No. 1 Y.R., shut-off. C-117.

Approved test of shut-off with the 12½" casing.

Well No. 1 Y.R., recement. CC-279.

After cementing the 12½" casing five times, it was found that, although the cement had set each time, water was coming in presumably at the casing joints. The proposal to put in the 10" casing and prospect ahead for oil sands was approved.

SANTA PAULA FIELD.

GENERAL DESCRIPTION.

This field includes the eastern one-half of the Rancho Ex-Mission, with the developed areas situated at the heads of Aliso, Wheeler, Salt Marsh, and Adams Cañons, on the south slope of Sulphur Mountain and the area adjacent to and east of Santa Paula Creek, as far as Timber Cañon. The southern limit of the field is the Santa Clara River.

Productive areas in this field are confined principally to narrow zones which follow the trend of faulting which is responsible for the formation of Sulphur Mountain and Santa Paula Ridge.

The western portion of the field, which lies at the foot of Sulphur Mountain, was developed by the Union Oil Company many years ago. No further prospective developments are recorded in this area during the past year.

Along the eastern extension of the field, and following the fault at the southern base of Santa Paula Ridge, four new wells commenced drilling during the fiscal year. The results obtained by drilling these wells will, in a large measure, determine the extent of further developments in this portion of the field.

PRODUCTION AND WATER CONDITIONS.

During the month of June, 1917, there were 34 producing wells in this field, according to the production reports received by this department. These wells averaged about 3 bbls. of oil and 1.5 bbls. of water per well per day during this month. A number of companies operating in this field have been dilatory in filing monthly production reports. Production reports received from one company, in which a report was made that wells on this property produced no water, are known to be at variance with the facts in this case.

The average daily production of producing wells in this field is small, but the life of the individual well is greater than the average producing well in other fields in the state.

A summary of notices received and decisions rendered for the fiscal year follows:

Section	Township	Range	Company	New wells		Test of water shut off		Deepen or redrill		Abandon	
				Notices	Decisions	Notices	Decisions	Notices	Decisions	Notices	Decisions
18	4 N	20 W	Timber Canyon Syndicate	1	1						
20	4 N	20 W	Santa Clara Oil & Dev.	1	1	1	1				
13	4 N	21 W	Empire Oil							1	1
15	4 N	21 W	Amer. Vent.	1	1						
21	4 N	21 W	Slocum Oil					1	1		
22	4 N	21 W	Amer. Vent.	1	1					1	1
			Totals	4	4	1	1	1	1	2	2

Detailed list of decisions and character of work done in the field for the past fiscal year follows:

DECISIONS.

T. 4 N., R. 20 W., S. B. B. & M.

SECTION 18.

The Timber Cañon Syndicate.

Well No. 1, drill. CC-222.

Approved proposal of the company to shut off water at a depth of about 300'.

SECTION 20.

Santa Clara Oil and Development Co.

Well No. 1, drill, CC-188.

The notice from the company stated that the depth at which water-bearing formations should be encountered was unknown. Recommended that water be shut off with each string which was landed.

Well No. 1, shut-off. C-138.

Test of water shut-off for 12½" casing landed at a depth of 143' was approved as satisfactory.

T. 4 N., R. 21 W., S. B. B. & M.

SECTION 13.

Empire Oil Co.

Well No. 3, abandon. CC-321.

Approved proposal of the company to abandon the well, specifying plugging with cement between certain depths and determination to be made that cement plugs set properly before removal of casing.

SECTION 15.

American Ventura Oil Co.

Well No. 2, drill. CC-233.

Approved proposal of the company to shut off water at a depth of about 400′.

SECTION 21.

Rancho Ex-Mission, Tracts "A" and "S"

Slocum & Co.

Well No. 1, deepen. CC-180.

Proposal of the company to deepen the well 250′ was approved.

SECTION 22.

American Ventura Oil Co.

Well No. 6, abandon. CC-192.

Recommended plugging the well with cement between certain depths, and determination to be made that cement plugs set properly before proceeding.

Well No. 10, drill. CC-232.

Notice from the company stated that water-bearing formations should be encountered at a depth of about 450′. Study of available data indicated that water should be shut off somewhere between a depth of from 400′ to 500′.

OJAI FIELD.

For the purpose of mapping and for convenience in filing of records, the Ojai field has been described by this department as including all of the area lying in the Rancho Ojai from the Ventura River on the west to the Santa Paula Creek on the east, and all of the area lying north of this ranch as far as the northerly boundary of Township 4 North.

The operating companies which were actively engaged in development of this field during the past year include the Pan-American Petroleum Co., the Great Republic Oil & Paint Co., Capitol Crude Oil Co., Santa Maria Crude Oil Co., and the West American Oil Co. As in the Santa Paula field to the south, the productive areas in this field are associated with the regions of faulting and attendant upon the uplift which has formed Sulphur Mountain and minor folding which has developed along the fault zones.

Development during the fiscal year has been confined to old known producing areas, and the proven area has not been extended. Table No. 3 shows 297 acres of proved oil land for the year 1916–17.

PRODUCTION AND WATER CONDITIONS.

According to information shown on monthly production reports, the water condition of wells producing in this field is not serious. The average daily production for the month of June, 1917, for the entire field was 146 bbls. of oil and 29 bbls. of water, or an average of 2.5 bbls. of oil and .5 bbls. of water per producing well per day.

Out of a total of 119 wells shown to have been drilled in this field, only 29 are now producing. Many of these wells were abandoned without penetrating productive oil sands and many have been abandoned on account of low production of oil.

The recent acquisition of large holdings of prospective oil land by the Pan-American Petroleum Co., and the number and distribution of wells started by this company at present writing, indicate that this field will be more thoroughly prospected during the coming year than for many years previous.

The following summary of notices received and decisions rendered shows the areas in which development has been active during the fiscal year:

Section	Township	Range	Company	New wells		Test of water shut off		Deepen or redrill		Abandon	
				Notices.	Decisions.	Notices.	Decisions.	Notices.	Decisions.	Notices.	Decisions.
8	4 N	21 W	Gr. Republic Oil & Paint Co.	1	1						
17	4 N	21 W	Capitol Crude	1	2	1	1				
11	4 N	22 W	Pan-Amer. Pet.	1	1						
12	4 N	22 W	Santa Maria Crude Oil					1	1		
19	4 N	22 W	West American Oil Co.			1	1	1	1		
			Totals	3	4	2	2	2	2		

Following is a list of decisions rendered showing the nature of the development for the past year:

DECISIONS.

T. 4 N., R. 21 W., S. B. B. & M.

SECTION 8.

Great Republic Oil and Paint Co.

Well No. 2, drill, CC-269.

Approved proposal of the company to shut off water at a depth of about 200′.

SECTION 17.

Capitol Crude Oil Co.

Well No. 25, drill. CC-269.

Notice of intention to drill received from the company stated that there was no water to shut off. Recommended that the company notify this department for test of water shut-off if a string of casing was landed above oil-bearing formations.

Well No. 25, shut-off. C-171.

Test of water shut-off for the 11⅝″ landed at 233′ approved as satisfactory.

Capitol Crude Oil Co.

Well No. 24. Letter 3/27/17.

Notice of intention to drill this well was filed with the Board of Supervisors of Ventura County, instead of with the State Mining Bureau, and the well was not drilled under the supervision of this department.

T. 4 N., R. 22 W., S. B. B. & M.

SECTION 11.

Pan-American Petroleum Co.

Well No. 7, drill. CC-310.

Approval to commence drilling was delayed on account of well records for this property not having been previously filed with this department. Information from well records was not complete nor sufficient to recommend actual depth of water shut-off. Recommended that oil-bearing formations from which adjoining wells produce, be protected from water.

SECTION 12.

Santa Maria Crude Oil Co.

Well No. 3, deepen. CC-294.

Approved proposal of the company to deepen this well and shut off water at a depth of 525'.

SECTION 19.

West American Oil Co.

Well No. 1, deepen. CC-121.

Approval given to deepen the well to possible oil sands. This was a prospect unfinished well.

Well No. 1, shut-off. C-144.

Test showed that large volume of surface water was shut off but some water and tar came into the well. Owing to the fact that this was a wildcat well, proposal of the company was approved to drill out bridge and test well by pumping for ninety days, and in case the oil sand was found commercially productive, a successful shut-off should be made above the oil sand.

VENTURA FIELD.

GENERAL DESCRIPTION.

The recently developed area situated near the city of Ventura and lying in the Ex-Mission, Cañada Larga and San Miguelito Ranchos, and certain government subdivisions lying to the west of Rancho San Miguelito and extending to the coast line, which area is included in Township 3 North, Ranges 23 and 24 West, S. B. B. & M., has been mapped by this department as the Ventura Field.

HISTORY OF DEVELOPMENTS.

Drilling was commenced by the Traders Oil Company on one of the first wells in this field in July, 1912. This well is located in Section 16, T. 3 N., R. 23 W., S. B. B. & M., on the west side of Ventura River Valley and about 2 miles north of the top of the Ventura anticline along which the more recent wells are drilling. This well has been drilled to a depth of 4140' and, according to the log record, slight showings of oil were encountered at a depth of about 3400', and the well is standing idle at the present time.

The first well was drilled on the Ventura anticline, on the east side of Ventura River Valley and on the west side of Rancho Ex-Mission, T. 3 N., R. 23 W., in the year 1914, by the State Consolidated Oil Co., and was abandoned after a depth of 1815′ had been reached. A slight showing of oil and gas was encountered at a depth of about 1600′. This well did not penetrate formations from which production was obtained at a later date from adjoining wells.

During the years 1914–1916, two wells were drilled by Joseph B. Dabney on the west side of Ventura River Valley, in Section 21, T. 3 N., R. 23 W. These wells reached a depth of about 500′ without penetrating oil-bearing formations and were abandoned in January, 1917.

The second well was commenced by the State Consolidated Oil Co. in March, 1915, and is now known as "Lloyd" No. 1. This well is located about 650′ south of the first well drilled by this company. Log records show that oil-bearing formations were penetrated in this well at depths of 2300′ and 2550′ respectively. The first oil-bearing horizon was shut off behind the $8\frac{1}{4}$″ casing. Water was probably shut off above the second showing of oil penetrated by this well and these formations were not tested for their productiveness on account of subsequent mechanical difficulties. Reference to list of official decisions given below gives a brief record of recent work done by the company.

Well No. 2 "Lloyd" of the State Consolidated Oil Co. commenced drilling in May, 1916. The well was drilled to a depth of 500′ with Standard tools and two joints of $15\frac{1}{2}$″ screw casing and 500′ of $12\frac{1}{2}$″ casing were landed. The $12\frac{1}{2}$″ casing was subsequently removed from the well. The hole was drilled from 500′ to a depth of 2250′ with rotary tools. Various formations carrying gas and considerable quantities of water were encountered above this depth. A strong showing of oil was encountered at a depth of 2185′. When a depth of 2250′ had been reached in drilling, a heavy flow of water from the well undermined the foundation of the derrick, which fell over, carrying with it drill pipe which had previously been pulled out of the well. Some gas and aprpoximately 100 bbls. of 56° Baumé gravity oil per day accompanied the flow of water. This well averaged about 12 bbls. of oil and 250 bbls. of water per day during the month of June, 1917. The flow of water, oil and gas from this well caused a crater to be formed at the mouth of the well. This crater was about 50′ in diameter and about 35′ deep. Two rotary pumps, a blowout preventor and some rotary tools were lost in this crater and have not been recovered from the well.

The necessity of repair work at this well to protect oil-bearing formations from water was called to the attention of the company on several occasions during the latter part of the year 1916, and the early part of

the year 1917. A hearing was held at Ventura on October 26, 1917, and the following formal order issued:

ORDER NUMBER FOUR

BY

STATE OIL AND GAS SUPERVISOR R. P. McLAUGHLIN

DATED OCTOBER 31, 1917,

RELATIVE TO

STATE CONSOLIDATED OIL COMPANY, LLOYD WELL No. 2, TRACT "R", RANCHO EX MISSION

IN VENTURA COUNTY.

"To *State Consolidated Oil Company,*

Mr. Ralph B. Lloyd:

It appearing to the supervisor that water in damaging quantities has access to productive oil sands in that certain well known as "Lloyd No. 2" of the State Consolidated Oil Company, situated on Tract "R", Rancho Ex-Mission, in the County of Ventura; and

It further appearing that said condition has existed for a long period of time, said supervisor has caused an investigation to be made, pursuant to Chapter 718, Statutes of 1915, amended 1917, and has determined that the following conditions exist:

The well was drilled to a depth of 500 feet with cable tools, 40 feet of 15½-inch screw casing was used as conductor from the bottom of the cellar, below the rig, and 500 feet of 12½-inch casing was placed in the well. About July, 1916, the 12½" casing was removed and rotary tools were used in drilling the well to a depth of 2250 feet, at which depth, in September, 1916, water and oil flowed from the well in such quantities that the ground around the well was washed away and the rig fell. There is at present no casing in the well.

The amount of water initially flowing from the well is reported to have been about 500 barrels per day, accompanied by about 100 barrels of oil per day. It appears that the State Consolidated Oil Company received certain payments of money as a bonus for having produced oil in said quantity. The amount of water now issuing from the well is said to be about seventy-five barrels per day, accompanied by about four barrels of oil per day. The market value of the oil at the well is about $2.25 per barrel.

It is reported by the State Consolidated Oil Company that about May 1, 1917, work was commenced for the purpose of filling the cavity about the well, erecting a rig, and placing casing in the well in such manner as to prevent water from entering the oil-bearing formations reported between a depth of 2185 feet and the bottom of the hole. The company further reports that since May 1, 1917, approximately two thousand dollars ($2000) has been expended for labor at the well.

On October 26, 1917, when the well was inspected by the supervisor, the cavity had been partly filled with earth, conductor pipe had been set over the well, pumps were carrying the flow of water and oil from within the conductor pipe, and forms were being constructed suitable for the building of concrete rig foundations.

There are some six other wells drilling in the immediate vicinity.

The geological conditions, together with the results of wells drilling in the neighborhood, indicate the probable existence of a considerable area of land likely to produce oil and gas in commercial quantities.

The interest of the people of the State of California, and persons owning property in the immediate vicinity, demands that work be actively and continuously carried on for the purpose of protecting said oil and gas deposits from damage by infiltrating water. The damaging condition having existed for more than a year, without evidence that reasonable progress has been made towards repair, it appears to the supervisor that a formal order should be issued for the purpose of insuring active and continuous repair work.

Now, therefore, pursuant to Sections 8 and 11, Chapter 718, Statutes of 1915, amended 1917, it is hereby ordered that:

First: Work of laying foundation and erection of drilling rig be continuously pursued in workmanlike manner.

Second: Screw casing not less than 15½ inches in diameter be placed in the well from the ground surface to a depth sufficient to insure a permanent and secure bond, by means of cement or otherwise, with the walls of the hole. Said casing to serve as a conductor and prevent fluid and gas from flowing from the well except through said casing. The depth and manner of securing said casing shall be determined to the satisfaction of the supervisor as conditions, encountered during progress of the work, may warrant.

Third: That in addition to the said conductor pipe, casing shall be placed in the well in such manner as to prevent water, encountered above a depth of 2185 feet, from passing to lower depths. The depth and manner of placing such casing shall be determined to the satisfaction of the supervisor as conditions, encountered during progress of the work, may warrant.

Fourth: After placing said conductor pipe and casing, such plugs as may be necessary shall be placed in the bottom of the well for the purpose of preventing any water encountered below oil or gas-bearing formations from entering same.

Deputy Supervisor M. J. Kirwan of Los Angeles is hereby authorized to represent the supervisor in so far as it may be necessary to inspect the work and receive proposals and reports concerning the same."

State Consolidated "Hartman" No. 1, Section 22, T. 3 N., R. 23 W.: This well is located about 900′ north of the State Consolidated Oil Co. "Lloyd" No. 2, and along the west line of Section 22. Drilling was commenced at this well on October 14, 1916. Upon receipt of notice of intention to commence drilling, recommendations were made by this department to shut off water at a depth of about 2200′. Study of peg model and cross sections prepared by this department subsequent to the issuance of this decision indicates that formations which are productive in "Lloyd" wells Nos. 1 and 2, and Shell Company "Hartman" No. 1, should have been encountered in this well at a depth of about 2200′. The log shows that this well has been drilled to a depth of 4000′ and that oil-bearing formations have not been encountered. A string of 10″ casing was cemented at a depth of 2583′ and failed to shut off water. This well was drilled with standard tools and kept full of thick mud to prevent gas blow outs. No attempt was made to test formations encountered between depths 2200′ and 2583′, in order to determine the nature of their contents.

Shell Co. of California "Hartman" No. 1, Section 22, T. 3 N., R. 23 W. This well is located about 600′ northeast from State Consolidated "Lloyd" No. 2. Drilling was commenced at this well January 27, 1917. The 12½″ casing was cemented at a depth of 1984′, in order to shut off water encountered above this depth. Ten inch casing was cemented in this well at a depth of 2193′. Test of water shut off was witnessed and approved by this department. The well was drilled to a depth of 2215′. Reference to the list of official decisions below gives a brief record and results of tests made at this well.

General Petroleum Corporation "Barnard" No. 1, Section 22, T. 3 N., R. 23 W., commenced drilling March 7, 1917. This well was drilled to a depth of 1980′ and 12½″ casing was cemented at a depth of 1976′. The well was shut down after cementing this casing, pending further developments in this area. Log records shows that oil or gas-bearing formations were not encountered in this well.

A conference was called by the State Oil and Gas Supervisor and held in the Los Angeles office of this department on June 13, 1917, to consider steps which should be taken towards necessary repair of certain wells drilled on the property of the State Consolidated Oil Co. This conference was attended by Mr. E. J. Miley of the State Consolidated Oil Co., Mr. Felix Chappellet of the General Petroleum Corporation, and Mr. Ralph B. Lloyd, representing certain land owners. Following this conference, written recommendations were made covering the details of work necessary for the repair of each well in the affected area.

Drilling operations were commenced by the Shell Co. of California at "Gosnell" well No. 1, on February 7, 1917, and at "Taylor" No. 1 on August 11, 1917, both wells located in Section 21, T. 3 N., R. 23 W., and at "McGonigle" No. 1, Section 23, T. 3 N., R. 23 W., on March 19, 1917. These wells are located near the top of the Ventura anticline. Considerable quantities of gas have been encountered in these wells, but oil in commercial quantities has not been developed up to the present time.

Reference to the following summary of notices and decisions shows that the General Petroleum Corporation is drilling two wells in Sections 17 and 22, respectively, of T. 3 N., R. 24 W.

Section	Township	Range	Company	New wells		Test of water shut off		Deepen or redrill		Abandon	
				Notices	Decisions	Notices	Decisions	Notices	Decisions	Notices	Decisions
21	3 N	23 W	Shell (Taylor)	1	1	1	1				
21	3 N	23 W	Shell (Gosnell)	1	1						
21	3 N	23 W	J. B. Dabney							2	2
22	3 N	23 W	Shell (Hartman)	1	1	1	1	1	2		
22	3 N	23 W	Gen. Petroleum	1	1						
22	3 N	23 W	State Consol.	1	1		1		1		
23	3 N	23 W	Shell (McGonigle)	1	1						
9	3 N	24 W	Kellerman & Vigus	1	1						
17	3 N	24 W	Gen. Petroleum (Hobson 2)	1	1						
21	3 N	24 W	Gen. Petroleum (Hobson 1)	1	1						
			Totals	9	9	2	3	1	3	2	2

Following is a list of decisions rendered, covering operations at wells in this field for the past year, accompanied by a statement showing character of work done at each well and recommendations made by this department.

DECISIONS.

T. 3 N., R. 23 W., S. B. B. & M.

SECTION 21.

Rancho Cañada de San Miguelito.

Joseph B. Dabney.

Well No. 2, abandon. CC-185.

Approved abandonment, as the well was shallow and no oil or gas sands had been encountered, no plugging was required.

Well No. 1, abandon. CC-186.

Approval given to pull 12½" casing. No plugging necessary, as the well did not penetrate oil-bearing formations.

Shell Co. of California.

"Taylor" Well No. 1, shut off water. C-204.

Data at hand indicates that the 12½" casing cemented at about 2077' did not shut off water. This report approved proposal of the company to cement 10" casing at a depth of about 2624'.

"Taylor" Well No. 1, commence drilling. CC-123.

Proposal of the company to shut off water at a depth of about 2500' was approved.

"Gosnell" Well No. 1, commence drilling. CC-247.

Approved proposal of the company to shut off water at a depth of about 2145'.

SECTION 22.

General Petroleum Corporation.

"Barnard" Well No. 1, commence drilling. CC-194.

Estimated water shut-off at a depth of about 2100' and recommended that all casing landed above oil sand should be cemented.

Rancho Ex-Mission, Tract "R".

State Consolidated Oil Co.

"Lloyd" No. 1, shut-off. C-143.

Test indicated that water from above a depth of 2542' was probably not passing to lower levels in the well. Proposal of the company, to deepen the well only through the sand encountered at time of test and pump the well, was approved.

"Lloyd" Well No. 1, redrill. CC-311.

Subsequent to report shown above the 6¼" casing was found to be collapsed at the bottom of the well and in attempting to remove this casing the well was shot 17 times between depths of 2542' and 1900'; portions of the 6¼", 8¼" and 10" casings were removed above 1900', and about 700' of 6¼", 8¼" and 10" casings frozen together fell back into the well as it was being removed, necessitating drilling up of this casing or sidetracking it in order to again reach the shut-off point. When the well was in this condition, the company filed a proposal to sidetrack all casing in the well below a depth of 1090' and re-cement with 10" casing at a depth of about 2200'. This department recommended that the company shut off water at a depth of about 2260' in order to test oil-bearing formations formerly shut off.

Well No. 1, Hartman, drill. CC-179.

Notice from the company to drill this well states that they expected to shut off water at a depth of about 2170'. Recommended that each string which was

landed should be cemented and that if water reported in well No. 2 "Lloyd" at 1800′ was the last water encountered, a shut-off should be made at a depth of about 2200′. The company failed to carry out this recommendation and it may be necessary to conduct certain tests to determine whether or not oil-bearing formations have been shut off when 10″ casing was cemented at a depth of 2583′.

Shell Co. of California.

Well No. 1, Hartman, drill. CC-208.

Approved proposal of the company to cement 12½″ casing at a depth of about 2230′.

Well No. 1, Hartman, deepen. CC-315.

Approval of proposal to deepen withheld until test of water shut-off was witnessed by this department.

Well No. 1, Hartman, shut-off. C-174.

Approved test of water shut-off with 10″ casing cemented at a depth of 2195′ and also approved proposal to deepen about 20′. (See decision No. CC-315.)

Well No. 1, Hartman, deepen. CC-298.

Approved company's proposal to deepen about 35′ to encounter second oil sand.

SECTION 23.

Shell Co. of California.

Well No. 1, "McGonigle," drill. CC-249.

Approved proposal of the company to shut off water at a depth of about 2870′.

T. 3 N., R. 24 W., S. B. B. & M.

SECTION 9.

Kellerman and Vignus.

Well No. 1, drill. CC-171.

Approved proposal of the company to drill this well, cementing each string of casing which was landed before reaching oil sands.

SECTION 17.

General Petroleum Corporation.

Well No. 2, commence drilling. CC-177.

Recommended that, as this was wildcat territory, each string of casing which was landed should be cemented and tested.

SECTION 22.

General Petroleum Co.

Well No. 1, drill. CC-176.

Recommended that the company cement and test each string of casing landed.

MISCELLANEOUS FIELDS.

Notice of intention to deepen well No. 1 of the True Oil Company, Section 2, T. 9 N., R. 24 W., was received by this department. This well is located in the northwest corner of Ventura County at the head of the Cuyama Valley. The work of deepening this has been recently commenced.

The following official decision was made relative to the work of deepening this well:

DECISION.

T. 9 N., R. 24 W., S. B. B. & M.

SECTION 2.

True Oil Co.

Well No. 1, deepen. CC-301.

The proposal of the company to deepen the well below a depth of 1772′ (original) depth) was approved.

CHAPTER III.

SANTA BARBARA AND SAN LUIS OBISPO, MONTEREY, AND SANTA CLARA COUNTIES.

By R. E. Collom, Deputy Supervisor.

The work of this department, in the district covered by the Santa Maria office, has taken the deputy, during the past year, into the Sargent field, near Gilroy; prospect operations on the San Juan River, south of Shandon; the Bradley field; the Arroyo Grande field, and the various fields in the Santa Maria district. These operations are all included in the district, designated for this office, as covering Santa Barbara County and all territory north to San Francisco and west of the summits of the Temlor and Mt. Diablo ranges. The bulk of the work in the Santa Maria office has been done in connection with the fields in the Santa Maria district in Santa Barbara County.

During the year just passed, almost all large operating companies in the State of California, as well as producers from Oklahoma, Texas, and other oil producing states, have turned, with interest, to the potential possibilities of the Santa Maria district. In numerous instances this office has been able to serve geologists and engineers of inquiring companies with time saving information relativve to the geology and other natural features of the district. One of the principal results of this interest among outside operators was the development of the Casmalia field, which now includes 3000 acres of proved oil land.

The two general causes for this activity were the ever-growing increase in consumption over production and the attitude of the Federal Government in the oil litigation in the San Joaquin Valley fields. This latter cause undoubtedly forced certain producers into low gravity territory which otherwise might have remained undrilled for some time to come.

There are still large acreages of undeveloped territory in the Santa Maria district. The experience in present Casmalia field development has shown that operators for many years had drilled wells around the edges of the productive area without encouraging results; and, in the examination of likely looking anticlines in the Lompoc, Cat Canyon and other areas, the engineer should hold this bit of Casmalia field history in mind.

It is true that numerous abandoned or idle wells, standing in the outskirts of present productive territory, have seemed to define the limits for drilling. It will be recalled, however, that in many cases

these "strippers" were drilled by stock companies, punching holes quickly, and eager to get a showing. Numerous "stripper" wells, shown on the map as abandoned, are only a few hundred feet deep. An inquiry addressed to any of the Santa Maria district operators will bring ample testimony to the fact that there are good producing wells in this field which did not show a trace of oil, even with a chloroform test, at the time of completion. It was only after the head of drilling water was pumped off the formations that oil began to show. So, with these past experiences and present improved drilling methods, it is probable that areas yet remain in the Santa Maria district to give a repetition of the history of the recently developed Casmalia field.

With few exceptions it may be said that the relations of this department and the operators in the district, with respect to the work of the department, have been upon a co-operative basis. Acknowledgment is made to the operators who, through this co-operative attitude, have made the carrying out of the work and instructions of this department a pleasure.

The deputy was assisted in the preparation of this report by an inspector, and a stenographer, both of whom have come into the office since the close of the fiscal year.

DESCRIPTION OF FIELDS IN DISTRICT No. 3.

Santa Maria District.

The Santa Maria District comprises the Casmalia, the Cat Canyon, the Lompoc, the Los Alamos and the Santa Maria fields.

The Casmalia field is bounded on the west by the Pacific Ocean, on the south by the San Antonio Valley to Harris Station, thence northerly by the California State Highway to Santa Maria. The northerly portions of this area lie in the Santa Maria Valley.

The Santa Maria field is bounded on the west by the California State Highway from Santa Maria to Harris Station, thence easterly to Careaga, and thence by a line running due north along the east line of the Newlove estate of the Union Oil Co. and intersecting with Santa Maria River.

The Cat Canyon field is bounded on the west by a line running due north from Careaga, on the California State Highway along the east line of the Newlove estate of the Union Oil Co. and intersecting with the Santa Maria River. It is bounded on the south by the California State Highway to point of intersection with the west line of La Laguna Rancho, thence northerly along the west lines of La Laguna Rancho and Tinaquaic Rancho, and includes prospect wells in the Tepusquet and La Brea Creek regions.

The Los Alamos field is bounded on the west by the eastern boundary lines of the Cat Canyon field, on the south by the California State

Highway to Los Olivos. The eastern and northern boundaries are determined by the foothills of the San Rafael mountains.

The Lompoc field is bounded on the west, from the mouth of San Antonio Creek to the mouth of the Santa Ynez River, by the Pacific Ocean, on the south by the Santa Ynez River to Santa Ynez Mission, thence northerly to Los Olivos, thence westerly to Zaca, on the California State Highway, and by the California State Highway to Harris; thence along San Antonio Creek to the ocean.

Arroyo Grande District.

The Arroyo Grande field comprises all proved and prospective territory between and adjacent to Arroyo Grande, Pismo and Edna, all in San Luis Obispo County.

Other fields.

There has not been sufficient work done in other fields in District No. 3 to warrant defining their limits at this time.

The number of wells in this district and the number of logs on file is shown by the following tabulation. Graphic logs are being drawn as fast as possible. The number already completed is also shown in the tabulation:

Summary of Well Records of District No. 3.

Field	Wells listed	Logs filed	Graphic logs	Wells accounted for by production reports	Number of wells for which production reports have been regularly posted
Casmalia	83	23	0	28	17
Cat Canyon	104	60	29	24	13
Santa Maria	284	246	197	222	83
Lompoc	57	44	19	28	5
Los Alamos	9	4	1	1	1
Arroyo Grande	18	2	0	3	0
Huasna	2	0	0	0	0
Carrisa	1	0	0	0	0
San Juan	1	0	0	0	0
Bradley	6	2	0	0	0
Sargent	13	12	0	7	0
Summerland	138	0	0	0	0
	716	393	246	313	119

Peg models covering above 2250 acres, or 21% of the proved land in the district, have been constructed.

The following table shows the totals of notices received and decisions rendered on proposed oil well operations in the various fields during the past year in District No. 3:

	New wells	Test of shut-off	Deepen	Redrill	Abandon	Total
Santa Maria Field—						
Notices	7	15	12	2	3	39
Decisions	*	10	11	2	2	25
Cat Canyon Field—						
Notices	25	35	2	7	12	81
Decisions	*	32	2	7	10	51
Casmalia Field—						
Notices	54	48		9		111
Decisions	*9	37	1	9		56
Lompoc Field—						
Notices			1	1	7	9
Decisions	*		1	1	7	9
Arroyo Grande Field—						
Notices	5	5	1	1		12
Decisions	*	5	2			7
Sargent Field—						
Notices	5	4			1	10
Decisions	*	4	1		2	7
Miscellaneous—						
Notices	2	2	3			7
Decisions	*		2			2

*In most instances decisions on notices of intention to drill new well were made on Form 113 and therefore are not included in totals, which cover only reports on Forms 109 and 111.

CAT CANYON FIELD.

In the Cat Canyon Field the following companies have been engaged in development operations during the past year:

Associated Oil Co.—Well No. 4, Sec. 31, T. 9 N., R. 32 W.

J. W. Goodwin—Well No. 1, Sec. 31, T. 9 N., R. 32 W.

Palmer Union Oil Co.—Wells Nos. 2 and 3, Sec. 30, T. 9 N., R. 32 W.

Pan-American Petroleum Investment Corporation—Wells Nos. 1, 2, 3, 4, Temporary Nos. 6A, 7A, 8A, 13A, 14A, 15A. All in Teresa Bell Tract, T. 8 N., R. 32 W., S. B. B. & M.

Pinal Dome Oil Co.—Wells Nos. 8 and 9, Sec. 26, T. 9 N., R. 33 W.

Santa Maria Oilfields, Inc.—Well No. 8, Sec. 23, T. 9 N., R. 33 W.; Well No. 1 Bell, Well No. 2 Bell, Sec. 22, T. 9 N., R. 33 W.

Standard Oil Co.—Shaw Ranch No. 3, T. 8 N., R. 32 W., S. B. B. & M.

West States Petroleum Co.—Henderson well No. 2, Sec. 30, T. 9 N., R. 32 W.

Details relative to above work may be found under record of "Notices Received and Decisions."

Water conditions.

The development operations in the Cat Canyon field during the period covered by this report have brought some unexpected and, in several cases, unusual water features. These new water conditions have been a hindrance to the rapid development desired in certain quarters. In selection of sites for drilling wells on the Palmer Union Stendell property and some of the later wells of the Pan-American Petroleum Investment Corporation on the Bell tract, it is notable that

a more systematic study by means of cross sections made from the logs of wells already drilled, would have brought conclusions radically different as regards probable depth of oil formations.

With a little less certainty it is true that the unusual water features, in a measure, could have been anticipated. It is now an established fact among Cat Canyon operators that no dependence can be placed upon the attitude of the Quarternary terrace deposits as indicating the position of anticlines in the oil formations. Reasons for this may be found under the subject of "Cat Canyon Oil Formations" in this report.

The following table gives comparative figures for water and oil produced for June, 1916, and June, 1917:

	June, 1916	June, 1917	Increase
Total fluid	59,644	74,269	14,625
Water	2,357	3,337	980
Oil	57,287	70,932	13,645
Number of wells producing	18	24	6

The foregoing shows that this Cat Canyon production is unusually clean, averaging about 4.5% water.

SANTA MARIA FIELD.

Water conditions.

Water conditions in the Santa Maria field have remained practically unchanged during the past year. The following table gives comparative figures on water and oil produced in June, 1916, and June, 1917:

	June, 1916	June, 1917	Increase
Total fluid	335,526	461,929	126,403
Water	107,131	160,205	53,074
Oil	228,395	301,724	73,329
Number of wells	185	196	11

Although it will be noted that there has been an increase in the total fluid produced, there has been a greater proportionate increase in the amount of water produced. This is in face of the fact that increase in oil is due principally to the Union Oil Co. work of deepening into the 3d oil zone on the Newlove lease.

These deepening operations represent the only work of importance that has been proposed during the year. The work has been carried out under the direct supervision of this department.

Remedial work.

There have been no proposals made for remedial work in the Santa Maria field during the past year. Although the deepening operations,

already mentioned, on the Newlove lease of the Union Oil Co., have been semi-remedial in character, the principal objective was the increased production to be gotten from the 3d oil zone. The advantage that the Union Oil Co. has gained in deepening wells to the 3d oil zone is instantly apparent to anyone who has followed Santa Maria field developments.

The Western Union Oil Co. stated to this department, by letter, on April 7, 1917, that arrangements had been made with the Union Oil Co. whereby this department should be requested to make an analysis of water conditions in the area called "Group B"[1] and outline necessary remedial work. This desire on the part of the companies concerned seems to have lacked the vitality necessary to carry it to the point of a written understanding. However, the deputy prepared necessary productiongraphs, cross sections, and other data on "Group B". It was found that the conditions in "Group B" are similar in many ways to those in other 2d zone areas in the Santa Maria field.

Recommendations.

On the Newlove, Hartnell, Squires, Escolle, Graciosa and a portion of the Careaga areas in the Santa Maria field, the 2d oil zone yields more water than oil. It is possible in some instances that wells drilled on intermediate locations into the 2d oil zone would produce, for a time, with a low water content; in fact, it is with this possibility in view that an effort is being made to seal 2d zone formations behind a string of casing wherever wells are being deepened. This sealing operation should have had the effect, if properly conducted, of preventing water, which usually occurs near the bottom of the 2d oil zone, from moving into the upper part of the 2d oil zone.

Where wells have been drilled completely through the 2d zone formations, it has been demonstrated in a number of cases that cement plugs—50 to 200 ft. in depth—placed in the bottom of these wells, have shut off the 2d zone water. The Western Union Oil Co. in several cases has remedied 2d zone wells by first plugging in bottom, and then perforating for 1st zone oil. The amount of oil gotten from the 1st oil zone usually compensates for the amount shut off in plugging. A study of the production data of one group of wells, some of which were plugged in bottom to shut off 2d zone water, shows that there may be cases where plugs are no longer effective, and tests should be made to determine if they are still in place.

The boundaries of the productive area of the Santa Maria Field are now practically defined. The productive life of the field depends entirely upon remedies to be applied to conditions as they now exist.

[1]First Annual Bulletin 73, C. S. M. B., page 200.

Although an operator may claim that he is raising all the water above ground that a well lets into the formation, the cost of handling this water is a factor not to be overlooked. When the water comes to the surface in the form of emulsion, the oil associated with it must be treated with steam or electric dehydrators. Emulsified oil must be held in storage awaiting treatment; this crowds storage facilities. Also, each time the oil is moved from one container to another, it is subjected to evaporation losses. Thus the presence of water adds additional cost and losses to the handling of the oil.

With the probable confirmation of reports to the effect that the Pinal Dome Oil Co.'s holdings have been purchased by the Union Oil Co. of California, the responsibility for the future of the Santa Maria Field evidently rests to a great extent with the latter company.

CASMALIA FIELD.

At the close of the year covered by the previous Annual Report, the companies operating in the Casmalia Field were the Casmalia Syndicate, with three wells on the Punta de Laguna Rancho; the Pinal Dome Oil Co., with two wells on the Escolle Tract, the Standard Oil Co., drilling two prospect wells on the westerly end of the Schuman Anticline.

At that time the Casmalia Syndicate No. 4 well was capable of producing 400 bbls. per day of 10 gravity oil. The well, however, was idle for lack of market.

At the end of June, 1917, the following companies are operating in the Casmalia Field:

Associated Oil Co.—Casmalia Syndicate, Ord Peshine property.
Dohney-Pacific Petroleum Co.—Soladino property, Lease No. 1, Lease No. 2.
Pinal Dome Oil Co.—Elizalde lease, Escolle lease, Quintero lease.
Shell Co. of California.—Todos Santos Rancho.
Standard Oil Co.—Pezzoni lease, Tognozzini lease.
Wilkes Bros. Inc.—Stokes lease.

Fifty-four applications to drill new wells were filed with this department during the year ending June 30, 1917.

Water conditions.

The following table gives comparative figures on water and oil produced for June, 1916, and June, 1917:

	June, 1916	June, 1917	Increase
Total fluid	2,000	67,446	65,446
Water	None	5,937	5,937
Oil	2,000 est.	61,509	59,509
Number of wells	1	13	12

When No. 4 well was drilled on the Arrellanes lease of the Casmalia Syndicate in 1916, top-water was entered at a depth of 135 feet. No other water stratum was found in drilling to prevent depth. The water problem in the Casmalia Field, at that time, seemed to be a simple one.

After development started on a large scale in September, 1916, the water situation in the Casmalia Field was found to be a difficult one for the following reasons:

1. There are several top water strata.

2. Certain portions of the brown shale takes up large quantities of drilling water.

3. From the top of the ground to the bottom of finished wells the formations are all shale. "Shells" occur at inconsistent intervals in various wells. Correlation of oil-bearing formations is therefore difficult.

4. Finished wells, producing clean oil at the rate of 400 to 1000 bbls. per day, would suddenly start producing water. The temperature of the water was as high as 142 degrees Fahrenheit.

When these conditions became known the operators realized the importance of establishing depths for stratigraphically uniform water shut-off. The Casmalia Field operators held a conference in the Mining Bureau office with the deputy and agreed to cooperate in every way possible to study and control the situation. Weekly drilling reports are furnished this department by the Casmalia Field operators for the purpose of keeping the field peg-model and well cross-sections up to date. Samples of water from every available definite source are being taken and analyzed. There is an organized determination to get at a solution of the difficulty.

In the Soladino-Arrellanes area a shut-off is made at depths of 700 to 900 ft. in order to exclude all top water strata.

The wells are then drilled through a heavy cold-tar zone. Very little drilling water is now used in these operations. Unless caving shale is encountered it has been found that the hole can be drilled practically "dry."

A second shut-off is made at a depth of 1200 to 1400 feet. This shut-off excludes the cold unproductive tar measure from the underlying hot-oil measures. The wells are then drilled into production at depths of 1500 to 1700 feet. It is a fortunate combination of circumstances that the oil, although heavy, is 130 deg. to 145 deg. F. in temperature and is therefore readily pumped.

The most difficult problem has been to account for the water suddenly appearing in clean producers.

A number of experiments involving bridging and plugging operations have led the operators to believe that the first wells were drilled

too deep. Some of these wells were drilled in shale to a depth of 1900 ft. or more. Several of these wells that have been bridged or plugged to a depth of say 1650 feet have shown marked improvement as to water.

Another indication that the water is coming from considerable depth is its high temperature. Also, wells recently drilled to shallower depths have not yet shown any quantity of water.

The following are the results of analyses of a number of samples of this supposed lower water:

TABLE A.

Well number	Total solids	Sodium carbonate	Sodium chloride	Sodium sulphate	Magnesium carbonate	Magnesium chloride	Calcium carbonate
Doheny Pac. Soladino, No. 3	254.40	82.10	136.86	1.53	3.91	None	2.23
Doheny Pac. Soladino, No. 4	220.00	76.00	141.00	2.10	-------	-------	*
Associated Oil Co. Arrellanes, No. 91	211 48	54.09	131.56	3.56	4.14	None	4.25
Doheny Pac. Lease 2, No. 1	794.83	96.83	635.80	5.11	4.10	None	1.75
Pinal Dome Oil Co., Escolle No. 2	528.96	65.24	412.95	None	2.84	None	2.57
Doheny Pac. Lease 2, No. 5	814.82	137.15	630.95	None	5.67	None	2.34
Associated Oil Co. Peshine, No. 21	361.80	70.59	241.86	None	4.13	None	4.36
Doheny Pac. Lease 1, No. 7	435.85	106.52	291.55	.54	3.77	None	3.08
Doheny Pac. Lease 1, No. 10	586.26	255.46	173.62	1.07	8.80	None	3.03

*Analysis incomplete.

TABLE B.

Well number	Total solids	Sodium carbonate	Sodium chloride	Sodium sulphate	Magnesium carbonate	Magnesium chloride	Calcium carbonate
Doheny Pac. Soladino No. 38	154.01	2.97	49.16	None	6.46	27.07	24.67

A comparison of the foregoing analyses, Table A, with the analyses of an "upper water"—that is, a water taken from above the oil measures, at a depth of 280 ft., in Doheny Pacific well, Soladino No. 38, Table B—shows a marked difference in the proportions of the various salts. It will be noted that the analyses in Table A run high in Sodium Carbonate and Chloride compared to the same salts in Table B, and that Magnesium Chloride is absent and Calcium Carbonate low, in Table A, but present in large proportions in Table B.

Geology of the Casmalia field.

The present developed portion of the Casmalia field lies along the crest and south flank of the Schuman anticline 1½ miles northeast of the town of Casmalia. From the west line of the Doheny Pacific property the anticline appears to be plunging toward the southeast at the rate of about ten feet to one hundred. The north flank of the

Schuman anticline is steep, dipping, and does not appear to be favorable for drilling.

The formation entered in drilling is Monterey shale. It is probable that the productive zone, judging from the hard, flinty nature of the shales, is the equivalent of the 2d oil zone in the Santa Maria field. A log of an old well, drilled to a depth of 2485 feet, indicates that the Vaqueros sand, 3d oil zone in Santa Maria field, should be entered at a depth of 600 to 800 ft. below the top of the present productive zone in the Soladino-Arrellanes group. The tar zone, above the productive zone in this group, seems to correlate with productive formations in wells farther to the southeast.

The oil.

The gravity of the oil varies from 9 deg. Baumé to 17 deg. Baumé. The oil is quite viscous. It is necessary to heat the heavy oil and mix it with distillate for transportation. An effort is being made in an experimental way to raise the gravity and decrease the viscosity by a cracking treatment.

The heaviest oil comes from wells at the westerly end of the anticline in the Soladino-Arrellanes area. Going southeasterly, along the plunge of the anticline, the oil becomes lighter. This change in gravity is probably due to the fact that the lighter fractions of oil in the formations near the apex of the anticline have had an opportunity to escape through fractures and crevices.

The unusually high temperature of some of the oil has already been mentioned in the discussion of water conditions.

LOMPOC FIELD.

Water conditions.

There has been no change in operating conditions in the Lompoc field during the past year. The following table gives comparative figures on water and oil produced for June, 1916, and June, 1917:

	June, 1916	June, 1917	Decrease
Total fluid	85,526	81,079	4,447
Water	38,827	37,836	991
Oil	46,699	43,243	3,456
Number of wells	26	27	

The Pacific Oilfields Ltd., completed the work of abandoning 6 wells on its property, Sections 28 and 33, T. 8 N., R. 34 W., S. B. B. & M., since the last report.

The Union Oil Co. of Cal., the Orcutt Oil Co., and the West Coast Oil Co. are the only companies operating in the Lompoc field at this time.

ARROYO GRANDE FIELD.

In the Arroyo Grande field 3 prospect wells are being drilled.

In the proved area the East Puente Annex Oil Co. drilled one well on the property of the Tiber Pacific Oil Co. The D. J. Oil Co. has drilled one well on the Muchado tract, and one well on the old Pacific Oilfields property. The D. J. Oil Co. is also engaged in redrilling operations on the old McNee property. These redrilling operations give promise of satisfactory results as the water is being shut off in old wells (see Report No. B-62), which were formerly good producers.

The following table gives comparative figures on water and oil produced for June, 1916, and June, 1917:

	June, 1916	June, 1917	Decrease
Total fluid	2,806	2,553	253
Water	96	75	21
Oil	2,710	2,478	232
Number of wells	4	4	

Oil formations.

In the Arroyo Grande field, near Edna, the oil is stored in the Pismo formation which overlies the Monterey. The Pismo beds appear to lie in gently dipping attitudes over the upturned and eroded edges of Monterey strata. It is probable that the oil now being produced, migrated from Monterey strata into its present reservoir. There are extensive outcrops of asphaltic rock along the northern border of the Arroyo Grande field.

The following log of a well, drilled in the north end of the field, shows that there are no extensive shale strata present in the Pismo formation, in this area, to act as a seal for the oil reservoir. The oil, therefore, made its own seal, in the form of asphaltic rock during the process of accumulation.

Log or well in Arroyo Grande field:

Formations Penetrated by Well.

Name of formation	Depth to top of formation	Depth to bottom of formation	Thickness
Adobe		35	35
Sand, showing water	35	100	65
Clay	100	125	25
Sand, carrying sulphur water	125	200	75
*Tar sand	200	690	490
Oil sand	690	712	122

*It is a portion of the "tar sand" logged between depths of 200 and 690 feet that outcrops on the northern boundary in the form of asphaltic rock.

BRADLEY FIELD.

The Bradley field lies 6 miles southwest of the town of Bradley, in Monterey County.

There have been eight wells drilled in this field. In April, 1917, the Asociated Oil Co. took over the old King well, of the Bradley Oil Co., in Section 36, T. 24 S., R. 10 E., M. D. B. & M. It is the intention to prospect for oil at Santa Margarita, Monterey contact.

Data on the geology and wells of the Bradley field are given by R. P. McLaughlin[1] in Bulletin 69.

SARGENT FIELD.

The produeing wells in the Sargent field are situated on the La Brea Creek, in the Sargent Ranch, on Section 31, T 11 S., R 4 E., M. D. B. & M.

One operating company controls the present proved area in this field. The Gilroy Oil Co. has been operating this property during the past year under lease from the Watsonville Oil Co.

The wells here are small producers. They vary in depth from 900 to 1600 feet. The gravity of the oil averages 17 deg. Baumé, and production reports show the fluid to be exceptionally low in water content. The logs of two wells show salt water below productive oil sands.

The following table gives comparative figures for water and oil produced during June, 1916, and June, 1917:

	June, 1916	June, 1917	Increase	Decrease
Total fluid	2,043	1,770		273
Water	3	120	117	
Oil	2,040	1,650		390
Number of wells	5	6	1	

Oil formations.

The oil-bearing formations in the Sargent field are closely associated with the Monterey. The productive wells have been drilled on the La Brea anticline. The beds are steep dipping. (There are extensive oil seepages along the north side of La Brea Canyon.) Structural features undoubtedly limit the possible productive area to a narrow belt running parallel to the axis of the anticline.

[1] McLaughlin, R. P., Petroleum Industry of California, Bull. 69, Cal. State Mining Bureau, 1914.

HUASNA FIELD.

The Huasna District lies directly north of the Santa Maria District in San Luis Obispo County.

Briefly the district is noted for numerous oil and tar seepages, and sulphur springs.

There is little of the younger Monterey present in the Huasna District. Sharp folding is the general rule. The oil seepages come, in many places, from fractures in upturned Monterey.

In the vicinity of the Huasna River the Monterey, or possibly the Vaqueros, is covered by Pismo formation. Petroleum of the Arroyo Grande field is found in the Pismo formation.

It is possible that an anticline in the Pismo formation in the Huasna District may form a reservoir for petroleum, providing the conditions of folding and erosion of underlying Monterey are favorable for the release into the Pismo of any petroleum present in the Monterey.

SUMMERLAND FIELD.

In the Summerland field there is very little change in the operating conditions, as well as the companies operating, from those covered by R. P. McLaughlin on pages 416-17 in Bulletin 69, Petroleum Industry of California, California State Mining Bureau, 1914.

The geology of this field is also briefly described in the above mentioned report.

GEOLOGY OF CAT CANYON OIL FORMATIONS.

Purpose of study.

In the First Annual Report[1] it was stated, with reference to Cat Canyon oil formations, that "The importance of identifying these formations rests with the proposition that if they are in the Fernando, the prospector would be assured a greater anticlinal continuity than has been evinced in the occurrence of petroleum in the Monterey domes of the district."

It was with the desire of throwing some light on this problem that the writer spent a great deal of his time during the past year in examining the geology of the Cat Canyon area, and other parts of the Santa Maria District.

There is not now enough definite stratigraphic or palæontologic evidence[2] to identify the Cat Canyon oil horizons conclusively with any one of the oil-bearing formations of the district. Data showing possible relations to Vaqueros, Monterey or Fernando are therefore given for the consideration of those interested.

[1]First Annual Report, Bull. 73, Cal. State Min. Bur.

[2]A fairly good specimen of *Phacoides annulatus Reeve* was taken from a depth of 3110 ft. in Stendell No. 3 Well of the Palmer Union. This species ranges from Monterey to living.

Vaqueros.

There is no direct evidence to support a supposition that the oil originates in the Vaqueros formation. On page 209 of the First Annual Report it was stated that in order to identify Cat Canyon producing sands with the Vaqueros it would be necessary to merge the "big blue" and "big brown" of the Santa Maria field rather indefinitely into the blue shale of the Cat Canyon field, overlying the producing sand. Such a correlation would satisfy general lithological requirements as to sand and shale.

Bailer samples from wells drilled on Sections 30 and 31, T. 9 N., Range 32 W., S. B. B. & M., show that the flinty-shale equivalent of the 2d oil zone of the Santa Maria and Casmalia fields (Monterey) underlies the Cat Canyon producing sand in a thickness of at least 600 ft., showing oil ond gas. This in itself would seem to eliminate the Vaqueros possibilities, remembering that the 3d zone production in the Santa Maria field comes from Vaqueros sand, beneath these flinty shales, and close to Vaqueros-Monterey contact.

Monterey.

Before the Cat Canyon field was developed, it was generally supposed that should any petroleum be found, it would be in the Monterey formation. Published geological cross sections[3] show the anticlines traversing the Cat Canyon area to be folds of Monterey formation, with thin coverings of Fernando or Terrace deposits. Development of the area showed that Cat Canyon production is coming from sand strata, whereas the Santa Maria field production, excepting the 3d zone, Vaqueros, was taken from shale strata.

The nature of sand reservoirs and the gravity of the oil seem to be the principal features which have caused a number of early engineers and geologists to claim that the Cat Canyon production is from the Fernando formation. There is little surface evidence to support such a theory.

On the contrary, considering the Monterey series in the time sense,[4] and not as an unbroken lithological unit of shale, it is quite possible for the sand members to be present in the Monterey and, from present data on the subject, it is the writer's belief that such is the case in the Cat Canyon field.

Monterey outcrops in Cat Canyon area.

In the Cat Canyon field the Monterey, with one exception, does not appear at outcrop. In the exception referred to, the Monterey shale outcrops on the lower portion of the northern slope of the Holland grade, Section 33, T. 9 N., Range 32 W., S. B. B. & M., and can be

[3] U. S. G. S. Bull. 322, Plate 7.
[4] The Monterey series in California-Louderback, Bull. Dept. Geol. U. C., Vol. 7, No. 10, pages 171-241.

traced by outcrops in an easterly direction to the exposed Monterey area in Foxen Canyon.

Fernando outcrops in Cat Canyon area.

Because of the scarcity of Monterey outcrops in the Cat Canyon area, a careful study was made of the surface geology. Several Fernando sections, in other parts of the district, were studied in order to determine, if possible, the age of Fernando beds, exposed in the Cat Canyon, and the probable depths of Monterey contact. A collection of Fernando fauna was gathered by the writer from 17 localities in the Santa Maria district, and turned over to the Palæontologic Department of Stanford University for classification.

Relative to the age of the lower Fernando as compared to prior determinations[5] for this and other districts, Dr. J. P. Smith states in a letter to the writer as follows:

> "I have been working over the fossils from the lower zone and I am quite sure they represent the Jacalitos-Etchegoin horizon—very lowest Pliocene."

The following is a list of part of the fossils referred to: (Identifications were made by H. H. Dievendorff under the direction of Dr. Smith.)

Locality: ½ mile N. of Schuman in R. R. cut.

Arca Trilineata Conrad,
Crepidula princeps Conrad,
Cardium quadrigenarium Conrad var. *fernandoensis* Arnold,
Crysodomus sp.?
Fusus sanctœcrusis,
Glycimerus coalingensis Arnold,
Monia macroschisma Dall,
Natica lewisii Gould,
Ostrea veatchi Gabb,
Oilvella intorta Carpenter,
Psephis sp.?
Panopea generosa Gould,

[5]The Santa Clara Valley, Puente Hills and Los Angeles Oil Districts—Eldridge & Arnold, Bull. 309, U. S. Geol. Surv., 1907. Geology and Oil Resources of the Summerland District, Arnold, Bull. 321, U. S. Geol. Surv., 1907. Geology and Oil Resources of the Santa Maria District, Arnold & Anderson, Bull. 322, U. S. Geol. Surv., 1907. Paleontology of the Coalinga District, Ralph Arnold, Bull. 396, U. S. Geol. Surv., 1909. The Fernando Group near Newhall, California, Walter A. English, Bull. Univ. of Cal. Dept. Geol., Vol. 8, No. 8—Nov. 7, 1914. Fauna from the lower Pilocene at Jacalitos Creek and Waltham Canyon, Fresno County, Calif. Jorgen O. Nomland; Bull. Univ. of Calif. Dept. of Geol., Vol. 9, No. 14, Feb. 24, 1916. Fauna of the Fernando of Los Angeles, Clarence L. Moody, Bull., Univ. of Calif. Dept. Geol., Vol. 8, No. 8, Oct. 11, 1916. The Geologic Formations of California, James Perrin Smith, Bull. 72, Cal. State Min. Bur., 1916. The Etchegoin Pliocene of Middle California, Jorgen O. Nomland, Bull. Univ. of Calif. Dept. Geol. Vol. 10, No. 14, April 19, 1917.

Phacoides annulatus,
Pecten ashleyi Arnold,
Pecten coalingensis Arnold,
Pecten estrellanus Conrad.
Pecten hastatus Sowerby,
Pecten stearnsii Dall.
Pecten healeyi Arnold.
Scutella gibbsi Remond.
Trochita radians,
Venericardia californica Dall.

The following tabulation gives the names of some of the fauna associated with the sea urchins (*Scutella gibbsi* Remond) in the conglomerate beds:

Name of species	Localities (see list under heading "Conglomerate Outcrops")						
	2	3	4	5	6	7	8
Scutella gibbsi Remond	×	×	×	×	×	×	×
Arca trilineata Conrad	×			×			
Dosinia ponderosa Gray				×			
Marcia oregonensis	×	×					
Macoma nasuta Conrad			×		×		
Modiolus sp. ?					×		
Chione sp. ?			×				
Nasa Moraniana Martin	×		×		×		×
Ostrea veatchi Gabb	×						
Panopea generosa Gould			×				
Tivella crassitaloides		×					
Crab claws					×		

The Fernando brackish water limestone beds and basal conglomerate beds (the latter containing *Scutella gibbsi* Remond) were found to be good Fernando markers. There are numerous outcrops of the limestone on the slopes of the hills flanking the Los Alamos valley. Near the Careaga ranch house in the Purisima hills; in the Careaga Canyon on the north side of the Los Alamos valley; and in several other localities running easterly along the north side of the valley, fresh water springs are found to be associated definitely with the limestone beds. Outcrops of the basal conglomerate beds cover a wide area, and are easily recognized by the fossil sea urchins.

Fernando section.

A cross section of Fernando beds on the north slope of the Purisima anticline, from exposures in the canyon running south from the Careaga ranch house, shows a thickness of 1400± feet between upper Fernando limestone and basal conglomerate.[6] The conglomerate overlies a stratum of fossiliferous yellow sand 400 ft. or more in thickness. This yellow sand is in contact with Monterey shale. Therefore

[6]See Columnal Section Pl. II, Bull. 322, U. S. G. S.

the total thickness from Fernando limestone to Monterey contact is 1800± ft. This columnar relation of conglomerate and yellow or white fossiliferous sand in contact with Monterey shale, is typical for the Santa Maria district. In localized areas there are beds of Monterey breccia at contact. The yellow contact sand varies in thickness. Sometimes it is absent, and the conglomerate rests directly upon Monterey shale. The greatest thickness of sand noted was 400 ft.

Conglomerate outcrops.

The following are some of the localities in which basal conglomerate, containing sea urchins, is found at outcrop:

1. Schuman anticline—in canyon east of road, ½ mile S. W. Arrellanes ranch house, at mouth of Schuman Canyon.
2. Escolle Canyon, 1 mile N. W. Righetti dairy, near Divide.
3. On Purisima anticline in Canyon 1¼ miles south of Careaga ranch house.
4. On Graciosa Ridge-Hartnell, Squires, Brookshire Oil Co. leases. Direct contact with Monterey.
5. Seventeen hundred feet S. 72 deg. W. of U. O. Co. well Harris No. 2.
6. Foxen Canyon, ½ mile south of Tognozzini place.
7. Cat Canyon, immediately east of A. O. Co. well, Williams No. 1.
8. On summit of Solomon hills ¾ mile W. of head of Howard Canyon.
9. One hundred yards east of U. S. Bench Mark at head of Howard Canyon.

In studying the Cat Canyon formation, it will be noted, from the foregoing list, that outcrops on the summit of the Solomon hills running westerly from the head of Howard Canyon to Williams Well No. 1 of the Associated Oil Co. on Section 31, T. 9 N., Range 32 W., S. B. B. & M., are of the basal Fernando (see localities 7, 8 and 9). Williams Well No. 1 was drilled to a depth of 3563 ft. The log of this well conforms closely with that of Union Oil Co. Well No. 3 (Bell) on the westerly edge of the Cat Canyon field, Section 26, T. 9 N., R. 33 W., S. B. B. & M. Each well is close to the anticlinal axis.

If the Cat Canyon oil formations are all of Fernando age, it is possible, from well logs and surface geology, to show that the Ferando is over 6000 ft. thick. This estimate is based on the following: 1600 ft. being the main thickness between Fernando limestone and Monterey contact[7] plus 3563 ft. (depth of Williams Well No. 1) plus a probable 800 to 1000 ft. of sand, clay, fresh water silica, etc., which lies above the Fernando limestone. None of the surface sections observed by the writer, however, include beds older than the basal conglomerate

[7]NOTE: Brea deposits and Monterey shale breccia occurring in limited areas at the base of the Fernando are not included in the estimate.

horizon already discussed. Furthermore, the writer has not seen any section of Fernando within the Santa Maria district where it may be said definitely that there are outcrops of oil sand within the section.

It is true that there are a number of localities where asphaltum or brea deposits, in most cases at visible Monterey contact, hold remnants of Fernando strata. Most of these brea deposits show fossils of a younger horizon than those of the Scotella beds. They indicate an unconformity within the Fernando, probably due to overlap, at some position between the basal conglomerate and limestone beds. Some of these localities are:

1. Waldorf Asphalt Mine,
2. New Pennsylvania Asphalt Mine,
3. Alcatraz Asphalt Mine,
4. Large area of asphaltic sand in the Zaca region,
5. Fugler Point Asphalt Mine.

An examination of the deposits in the localities mentioned shows, with the possible exception of Fugler Point, that the asphaltum has originated directly and locally from eroded Monterey shale. The brea and asphaltum deposits are neither the residue from a movement of oil out of Fernando sand, nor do they indicate the possibility of a petroliferous reservoir at Fernando-Monterey contact. A study of the structure of the Monterey in the Santa Maria district will show that the asphaltum and brea occur at the top of anticlinal folds where oil bearing Monterey beds have been eroded and the oil released. It will show that the brea deposits cited above occur only locally at points of overlap within the Fernando column. It will show that, in the great mass of rocks of Fernando age, which lie on the north flanks of the Schuman and Purisima anticlines and in the Foxen Canyon area, there is no evidence of any oil-bearing stratum from Monterey contact to the youngest part of the Fernando.

Referring to the possible exception at Fugler Point asphalt mine it was noted that within the mine itself there appears to be a Fernando oil sand. The stratum is 1½ to 2 ft. thick. The main body of asphaltum appears to have no definite system of bedding and is commonly described as a "blow-out". This appears to represent the exact condition. From the knowledge of method of occurrence of other brea deposits in the district it would be reasonable to assume that this asphaltum is the remains of oil that had been forced, through fractures, into the Fugler Point Fernando from Monterey beds at no great distance underneath. This assumption would be further supported by the fact that the asphaltum contains many angular fragments of diatomaceous shale, identical in texture. These fragments could not have moved through an oil sand.

Common sources of error.

Aside from the non-existence of outcrops of oil sands in Fernando sections, there are a number of ways in which errors may be introduced into the calculations of Cat Canyon stratigraphy.

One of the most common sources of error, and the one which, if allowed, greatly increases the thickness of the Fernando column, is due to confusion of identity between Terrace and Fernando outcrops. The area lying north of Cañada del Gato and west of Foxen Canyon is usually thought to show both Terrace (Quarternary) and Fernando beds at outcrop. In the canyon just east of the West Oil Co. Well No. 1, Section 30, T. 9 N., Range 32 W., S. B. B. & M., are beds of sand and gravel, dipping gently in a northerly direction, which were thought to be Fernando. In these beds, however, the writer has found, in places, small conglomerate boulders. These conglomerate boulders contain the characteristic fossil *Scutella gibbsi* of the basal Fernando. In other words, a portion of the material composing this Quarternary area was derived from basal Fernando beds.

Relative to the attitude of these proved Terrace deposits, it is noteworthy that a peg model of the oil wells on Section 30, T. 9 N., R. 32 W., S. B. B. & M., shows that an anticline, as indicated by the beds at the surface, does not exist in the oil formations in this area.

Another source of error in locating anticlinal structures for prospecting in this area is due to the use of dips taken on planes of pseudo-stratification both in Terrace and Fernando beds.

In a study of Cat Canyon formations Dr. G. D. Louderback[8] applied the term pseudo-stratification to any structure that closely simulates stratification or bedding both with horizontal attitude and with considerable inclination to the horizontal without relation or reference to the amount of tilting that has been suffered by the formation in which it is found and in no sense an expression of true stratification as being an original laying down of the rock mass layer upon layer on some preexisting basement or floor.

In the Cat Canyon area and elsewhere in the Santa Maria district it is often the case that the pseudo strata are not only quite prominent but are more pronounced than the true strata. This condition will always give misleading dips and sometimes indicate just the opposite of the true structure.

The oil-bearing sand strata.

The presence of these sand strata may be explained through the possible existence of an area of coarser sedimentation in the equivalent of the "big blue" of the Monterey in the Santa Maria field. This explanation is supported by the following conditions:

[8]Pseudo-Stratification in Santa Barbara County, Calif., by Louderback, Univ. of Cal. Bull. Dept. Geol., Vol. 7, No. 2, pp. 21-38, May 25, 1912.

1. In the Palmer (Stendell) area these sand strata, inter-bedded with blue shade, immediately overlie the oil-bearing brown flinty shales, similar to those of the second oil zone of the Santa Maria and Casmalia fields. In the Santa Maria field the shale horizon overlooking the 2d oil zone is known as the "big blue."

2. There is little variation in the texture of the sand in the strata throughout the Cat Canyon area. It is very fine, in color, and different from any Fernando sand observed elsewhere in the district. In other areas the sand is usually coarse, at times grading into small pebbles.

3. In correlating the productive sand strata in a number of wells drilled on the Santa Maria Oilfields, Pinal Dome, Palmer Union, Union Oil (Bell) and Pan-American properties, it has been observed that the thickness of the sand strata decreases in southerly and westerly directions from approximately the center of the east line of Section 26, T. 9 N., R. 33 W., S. B. B. & M. It also has been noted definitely in certain wells which appear to be on the westerly edge of the productive area in the Cat Canyon, that at depths where cross-sections from well logs indicated the point for entering productive oil sand, the formation entered was non-productive sandy shale. This would seem to indicate a zone of transition from sand to clay sediments, stratigraphically equivalent.

The following tabulation is made to show the variableness of the different sand and shale members which, taken together, are supposed to be equivalent to the "big blue" of the Santa Maria field:

	NE. ¼ of NW. ¼ of Sec. 27, T. 9 N., R. 33 W., S. B. B. & M.	Northeasterly side S. M. O. F. Palmer-Union area, Sec. 23, T. 9 N., R. 33 W., S. B. B. & M.	Southwesterly side S. M. O. F. Palmer-Union area, Sec. 27, T. 9 N., R. 33 W., S. B. B. & M.	New Penn Brooks area, Sec. 30, T. 9 N., R. 22 W., S. B. B. & M.	Pan-American Union (Bell) area.
*Top of brown shale	Irregular	Irregular	Irregular	Irregular	Irregular
Average thickness heaving tar sand at bottom of brown shale	21 ft.	12 ft.	30 ft.	Present only in 2 wells, 10 ft. Tar showing at bottom of shale.	Sand absent. Tar showing at bottom of shale.
Average thickness blue shale, bottom of brown to top of oil sand	912 ft.	450 ft.	860 ft.	325 ft.	1,200 ft.
Average thickness top oil sand	No sand	130 ft.	38 ft.	86 ft.	12 ft.
Greatest thickness any oil sand	350 ft. (sandy shale)	185 ft.	60 ft.	150 ft.	35 ft.
Top of heaving sand to top of brown flinty shales. (Equivalent "big blue")	Indeterminate	Indeterminate	1,850 ft.	1,680 ft.	Indeterminate

*Probable unconformity here with overlying beds.

4. At the base of the northern slope of the Holland grade, leading south over the hills from Cat Canyon, are strata of diatomaceous shale, inter-bedded with fine yellow sand or sandy shale. The attitude of the strata is unconformable with that of the basal Fernando beds of yellow fossiliferous sandstone and conglomerate which cover the top of Los Alamos peak, and other parts of the Solomon hills in that vicinity. These diatomaceous beds can be traced continuously by outcrops to the Monterey area, three miles to the east in Foxen Canyon. There are numerous fossil casts in these diatomaceous beds, among which are Venericardia sp., and Area sp. None of the species appear to be definite formational markers. In this connection it was observed that fossil casts are also present in the diatomaceous shales near Pine Canyon in the Santa Maria field, and in the bituminous shale in the old mine above the old Syndicate Oil Co. well on the Schuman anticline. These shales are Monterey.

5. A peg model of wells on Section 30, T. 9 N., R. 32 W., S. B. B. & M., and wells bordering the section, shows that the brown flinty-shales, already mentioned as being the probable equivalent of 2d zone formations in the Santa Maria field, are not only conformable with the productive sands, but that they are formed into a dome structure. The fact that these brown flinty-shales are logged in wells drilled in Sec. 30, but have not as yet been entered in wells drilled on Section 26, T. 9 N., R. 33 W., might be held as proof by some that there is an unconformity between these shales and the overlying productive oil sands. Aside, however, from the evidence of the peg model already cited, a study of the foregoing tabulation of thicknesses of strata will show that there is a marked increase westerly in the thickness of shale bodies, comparing those of Section 30, T. 9 N., R. 32 W., with those of Section 26, T. 9 N., R. 33 W.

Gravity of the oil.

There is a difference of 10 to 15 degrees Baumé in the gravities of Cat Canyon petroleum and that produced in the Santa Maria field, the former being the lower. It can hardly be held that geologic age influences the gravity of oil and as an instance of the variation in gravities elsewhere, the Casmalia field production is cited. This production, which varies from 8.8 deg. to 17 deg. Baumé, is known to come from the Monterey formations.

It is possible to find an explanation of the difference in the physical characteristics of the oils by considering the geologic structure of the Cat Canyon, Santa Maria and Casmalia fields. In the Santa Maria field the petroleum, excluding the first oil zone, lies in a closed dome. There has been no apparent opportunity for the petroleum or any of

its higher fractions to escape: there may have been opportunity for minor fractionations within the dome.

The formations of the Cat Canyon area are exposed in numerous places, such as at Fugler Point, Alcatraz Asphalt Mine, Zaca Creek, etc., and enormous quantities of petroleum have escaped from the Monterey shales in this area. The same condition holds for the northerly end of the Schuman anticline of the Casmalia field, where almost the entire series of the Monterey formation is exposed in successive outcrops, progressing in a westerly direction toward the ocean. There is much asphaltum in this locality, and it would appear that the exposures of "mother shales" in the Cat Canyon and Casmalia areas has not only permitted the loss of large quantities of petroleum, but also a portion of the lighter fractions of the petroleum that remains.

DECISIONS.

CAT CANYON FIELD.

T. 9 N., R. 32 W., S. B. B. & M.

SECTION 29.

Palmer Union Oil Co.

Well No. 12, abandon. BB-90.

Proposal to abandon account of no production approved.

Well No. 13, abandon. BB-46.

Proposal to abandon account of no production approved.

SECTION 30.

West Oil Co.

Well No. 1, abandon. BB-33.

Proposal to abandon approved. Notice of intention to abandon was later canceled account of considerable oil showing in the well during work preparatory to abandonment.

J. W. Goodwin.

Well No. 2, abandon. BB-21.

Proposal to abandon approved. Notice of intention to abandon was later canceled. See following report BB-67, for further history on operations at this well.

West States Petroleum Co.

Well No. 2, perforate casing. BB-67.

Some time after the notice of intention to abandon, J. W. Goodwin Well No. 2 had been canceled, the West States Petroleum, now the United Western Consolidated, took over the well and submitted proposal to perforate 6¼" casing from 2615' to 2800'. Their intention was to obtain production from formations corresponding stratigraphically to those from which the Palmer Union Oil Co. is producing through the 8¼" casing in Stendell Well No. 1. From data at hand the Deputy recommended that 6¼" casing be perforated between depths of 2390' and 2670', instead of at the depths proposed, in order to get the production desired. Production was increased from 10 barrels per day to 150 barrels per day.

Palmer Union Oil Co.

Well No. 2, shut-off. B-53.

Shut-off a failure. Recommended cementing a string of 10" casing.

Well No. 2, Stendell, shut-off. B-68.

Shut-off not conclusive. Later developments showed presence of another water sand at a short distance below.

Palmer Union Oil Co.

Well No. 2, Stendell, shut-off. B-105.

Shut-off successful. Water sands, unexpected and unusual to the territory, made three shut-offs necessary in this well.

Well No. 3, shut-off. B-56.

Shut-off successful.

Well No. 3, shut-off. B-80.

Shut-off successful.

Well No. 3, Stendell, shut-off. B-98.

Shut-off not successful. Deputy made the following conclusions as to probable source of water:

1st: From back of 6¼" casing.

2d: Drilling water returned from formations below the 6¾", logged at depth of 2963'.

3d: Water native to formations, but not logged between depths of 2995' to 3264'.

4th: Water let into formations between depths of 2963' and 3234' by Stendell water well (old Standell No. 13).

The Deputy also made the following recommendations:

1st: Immediately place all available information relative to Stendell Well No. 13 at the disposal of this department.

2d: Set a 4½" liner in Stendell Well No. 3, and make pumping test to determine the productivity of supposed oil formations below the 6¼" shut-off.

In explanation of the foregoing, it may be stated that Stendell Wells Nos. 2 and 3 were being drilled at the same time in territory in which unusual water conditions developed.

New Pennsylvania Petroleum Co.

Well No. 1, abandon. BB-32.

Proposal to abandon approved.

Well No. 1, shut-off. B-27.

Cement plug in water string, on abandonment job, tested for depth by this department.

SECTION 31.

Brooks Oil Co.

Well No. 2, abandon. BB-92.

Work of abandonment on this well was started without the knowledge or approval of this department. On June 16th, however, notice of intention to abandon was filed and approved.

J. W. Goodwin Oil Co.

Well No. 1, deepen. BB-50.

Proposal to deepen approved.

Well No. 1, shut-off. B-65.

Shut-off satisfactory.

Pinal Dome Oil Co.

Well No. 2, Santa Maria Enterprise, redrill. BB-69.

Proposal to redrill approved. Recommended cementing a string of 6¼" casing at a depth of 2010'

Associated Oil Co.

Well No. 4, shut-off. B-25.

Shut-off satisfactory.

Well No. 4, shut-off. B-37.

Shut-off satisfactory.

T. 9 N., R. 33 W., S. B. B. & M.

SECTION 22.

Pinal Dome Oil Co.
Well No. 3 LF, shut-off. B-57.
Shut-off satisfactory.
Well No. 2 LF, shut-off. B-19.
Shut-off satisfactory.

SECTION 23.

Santa Maria Oil Fields, Inc.
Well No. 3, redrill. BB-42.
Proposal to redrill approved.
Well No. 3, redrill. BB-65.
Proposal to redrill approved.
Well No. 8, shut-off. B-108.
Shut-off satisfactory.

Palmer Union Oil Co.
Well No. 8, abandon. BB-44.
Proposal to abandon approved.
Well No. 8, shut-off. B-46.
Witnessed test for cement plug in water string on abandonment job.

SECTION 26.

Pinal Dome Oil Co.
Well No. 7-B, shut-off. B-21.
Shut-off satisfactory.
Well No. 7-B, shut-off. B-35.
Shut-off satisfactory.

Union Oil Co.
Well No. 4, Bell, redrill. BB-35.
Proposal to redrill approved.

Palmer Union Oil Co.
Well No. 2, redrill. BB-52.
Proposal to redrill liner approved.
Well No. 6, abandon. BB-40.
Proposal to abandon approved.
Well No. 7, abandon. BB-43.
Proposal to abandon approved.
Well No. 7, shut-off. B-34.
Witnessed test for position of cement plug in water string on abandonment job.
Well No. 9, abandon. BB-45.
Approved proposal to abandon.
Well No. 9, shut-off. B-52.
Witnessed test for position of cement plug in water string on abandonment job.

SECTION 27.

Santa Maria Oil Fields, Inc.
Well No. LF-1, redrill. BB-38.
Original hole abandoned at 2100′ account being crooked. Left some casing in hole. No productive sands entered. Moved rig 24′ and started new hole. In drilling new hole, at about 1200′, the drill struck the casing and junk in the old hole.
Well No. 1-LF, abandon. BB-57.
Proposal to abandon approved.
Well No. 2, Bell, shut-off. B-91.
Shut-off satisfactory.

Santa Maria Oil Fields, Inc.

Well No. 2-B, abandon. BB-83.

Proposal to abandon approved.

Well No. 2, abandon. BB-91.

6¼" casing froze in the hole account of shifting formations, causing a bend in the pipe. Proposal to shoot and plug in shales between various oil sands approved.

Bell Ranch.

Oilfields Syndicate (W. P. Hammon).

Well No. 1, plug off bottom, redrill. BB-59.

This company proposed to shoot off 6¼" casing at a depth of 3100′, and plug with cement back to 2991′, in order to exclude water thought to be coming from below the productive oil sands. Proposal was approved. Subsequent pumping tests showed that free water had been eliminated, although the well still shows 12% emulsion.

Pan-American Petroleum Investment Corporation.

Well No. 1, shut-off. B-44.

Shut-off approved, upon statement of superintendent.

Well No. 2, shut-off. B-38.

Shut-off approved.

Well No. 3, shut-off. B-45.

Shut-off approved, upon statement of superintendent.

Well No. 4, shut-off. B-50.

Shut-off approved.

Well No. 4, shut-off. B-107.

Second shut-off made to exclude salt water logged in sand between depths of 2845′ and 2870′. This sand seems to correlate with oil sand in wells farther to the northwest. Possible edge-water conditions. Shut-off satisfactory.

Well No. 6-A, "Temporary," shut-off. B-61.

Shut-off satisfactory.

Well No. 7-A, "Temporary," shut-off. B-71.

Shut-off passed as satisfactory upon statements of superintendent.

Well No. 8-A, "Temporary," shut-off. B-100.

Shut-off passed as satisfactory upon statements of superintendent.

Well No. 13-A, "Temporary," shut-off. B-76.

Shut-off passed as satisfactory upon statements of superintendent.

Well No. 13-A, "Temporary," shut-off. B-90.

This shut-off was made without consulting this department. When the well was drilled ahead after shut-off as recorded in Report B-76, a salt water stratum, with fluid level of 900′, was entered at depths of 2561′ to 2579′. This water stratum appears to correlate with the first slightly productive oil sand entered in wells to the west. Here is additional evidence of a possible edge-water condition. This shut-off was satisfactory.

Well No. 15-A, "Temporary," shut-off. B-95.

Shut-off passed as successful upon statements of superintendent.

Well No. 15-A, "Temporary," shut-off. B-111.

This shut-off was made without the knowledge of this department. Owing to shortage of help in the Santa Maria office at this time it was difficult for the Deputy to keep in personal touch with Pan-American operations, and in this particular instance, as well as that cited in Report B-90, we were not kept informed of these unusual water conditions.

This shut-off was made to exclude salt water logged between depths of 2690′ and 2705′. Fluid level was 880′. As this water stratum appears to correlate with oil strata in wells farther to the northwest, this would appear to be another instance of edge-water.

Shaw Ranch.

Standard Oil Co.

Well No. 3, shut-off. B-55.

Shut-off approved.

Well No. 3, shut-off. B-87.

Shut-off not successful. No water logged back of the string of pipe. Shut-off made as a precautionary measure. Well passed for production test. Water, which appeared in bailing test, was thought to be drilling water held behind the casing.

SANTA MARIA FIELD.

T. 9 N., R. 33 W., S. B. B. & M.

SECTION 19.

Rice Ranch Oil Co.

Well No. 1, deepen. BB-47.

Proposal approved.

New Pennsylvania Petroleum Co.

Well No. 2, deepen. BB-58.

Proposal to deepen approved. Deepened 5′ to increase production.

Well No. 8, shut-off. B-66.

Shut-off satisfactory.

T. 9 N., R. 34 W., S. B. B. & M.

SECTION 22.

Union Oil Co.

Well No. 4, Hartnell, deepen. BB-60.

Proposal to deepen approved with understanding that second zone formations will be sealed with cement.

SECTION 24.

Pinal Dome Oil Co.

Well No. 8, Graciosa, deepen. BB-22.

Proposal to deepen approved. Recommended sealing second zone formations with cement.

Well No. 13-A, shut-off. B-29.

Shut-off approved.

Well No. 23-P, shut-off. B-23.

Shut-off approved.

Los Alamos Rancho.

Well No. 1, Graciosa, deepen. BB-54.

Proposal to deepen approved with understanding that second oil zone formations will be sealed with cement in making a shut-off before entering the third oil zone.

Well No. 2, Harris, shut-off. B-64.

Shut-off satisfactory.

Well No. 5, Graciosa, cement string of 4½″. BB-81.

Water appeared in the shales beneath the 6¼″ shut-off. It was originally intended to carry the 6¼″ casing below to second zone water, but the shut-off was probably made too high. It was therefore necessary to cement an additional string of casing in order to exclude waters below the 6¼″ shut-off from the third oil zone.

Western Union Oil Co.

Well No. 3, remove casing. BB-85.

Proposal to remove portion of oil string approved.

Well No. 38, deepen. BB-70.

Proposal to clean out and deepen about 100′ approved.

Western Union Oil Co.

Well No. 38, abandon. BB-80.

Work of abandonment completed without notice being filed with this department. Subsequent review of the records as to work of abandonment showed that the work had been performed in a manner satisfactory to this department.

Well No. 58. Shut-off. B-47.

Shut-off satisfactory.

Well No. 58, shut-off. B-18.

Shut-off satisfactory.

Well No. 59, redrill. BB-56.

This well was formerly known as No. 35, and had been abandoned after losing a string of tools. The proposal to erect a derrick over the well and clean out to first oil zone was approved.

Well No. 60, shut-off. B-33.

Shut-off satisfactory.

Well No. 61, shut-off. B-72.

Shut-off satisfactory.

Newlove Lease.

Union Oil Co.

Well No. 5, Newlove, deepen. BB-19.

Proposal to deepen approved, with understanding that second oil zone formations will be sealed with cement.

Well No. 5, Newlove, shut-off. B-85.

Shut-off satisfactory.

Well No. 6, Newlove, deepen. BB-34.

Proposal to deepen approved with understanding that second oil zone formations will be sealed with cement.

Well No. 6, Newlove, shut-off. B-84.

Well flowed and could not make bailing test. Production test showed shut-off to be satisfactory.

Well No. 14, Newlove, abandon. BB-31.

Proposal to abandon approved.

Well No. 44, Newlove, shut-off. B-67.

Formation shut-off passed as satisfactory upon statements of superintendent.

Well No. 17, Newlove, shut-off. B-51.

Shut-off satisfactory.

Well No. 17, Newlove, deepen. BB-20.

Proposal to deepen approved. Intention to shut off below, and seal, second zone formations with cement.

Well No. 33, Newlove, deepen. BB-61.

Proposal to deepen approved with understanding that second zone will be sealed with cement.

Well No. 43, Newlove, abandon. BB-37.

Proposal to abandon approved.

Section 34.

Union Oil Co.

Well No. 4, Cal. Coast, deepen. BB-48.

Proposal to deepen approved with understanding that second oil zone will be sealed with cement.

CASMALIA FIELD.

T. 9 N., R. 34 W., S. B. B. & M.

Punta de la Laguna Rancho.

Doheny Pacific Petroleum Co.

Well No. 1, Soladino, shut-off. B-30.

Shut-off approved upon statement of superintendent. Test made without informing this department.

Doheny Pacific Petroleum Co.

Well No. 1, Soladino, shut-off. B-41.

Shut-off satisfactory.

Well No. 1, Soladino, redrill. BB-63.

Proposal to bridge and cement string of 10" in order to make shut-off stratigraphically uniform with that of neighboring wells approved.

Well No. 2, Soladino, shut-off. B-31.

Test for shut-off approved upon statement of superintendent. Test was made and the well drilled ahead before this department was notified.

Well No. 2, Soladino, shut-off. B-40.

Shut-off satisfactory.

Well No. 3, Soladino, shut-off. B-32.

Deputy was not present at this test, due to misunderstanding as to what kind of tests should be witnessed. Shut-off approved, however, upon statement of superintendent.

Well No. 3, shut-off. B-43.

Shut-off satisfactory.

Well No. 3, Soladino, re-cement. BB-87.

Proposal to bridge and cement a string of 10" casing in order to make a shut-off stratigraphically uniform with those in adjacent wells, approved.

Well No. 4, Soladino, shut-off. B-39.

Shut-off satisfactory.

Well No. 4, Soladino, re-cement. BB-86.

Proposed to bridge and cement string of 12¼" casing in order to make shut-off stratigraphically uniform with shut-offs in adjacent wells, approved.

Well No. 5, Soladino, shut-off. B-42.

Shut-off satisfactory.

Well No. 5, Soladino, re-cement. BB-88.

Proposal to bridge and cement a string of 10" casing in order to make a shut-off stratigraphically uniform with shut-offs in adjacent wells, approved.

Well No. 6, Soladino, shut-off. B-69.

Shut-off not satisfactory. Well was passed with understanding that another string of casing would be cemented before entering producing formations.

Well No. 6, Soladino, shut-off. B-88.

See report B-69. Shut-off satisfactory.

Well No. 7, Soladino, shut-off. B-60.

Shut-off satisfactory.

Well No. 7, Soladino, shut-off. BB-66.

On account of heaving formations, unable to make bailing test. Well was passed for drilling into producing formations, and pumping test for shut-off.

Well No. 11, Soladino, drill. BB-72.

Proposed point of shut-off rejected account of no provision being made for protection of the "Big Brown" tar-bearing formations. Recommended either cement and string of casing at top of "Big Brown" formation or cementing a string of casing 250' lower than proposed depth of shut-off, using sufficient cement to seal all "Big Brown" formations.

Well No. 12, Soladino, drill. BB-78.

Proposed depth of shut-off rejected account of no protection provided for "Big Brown" tar-bearing formations. Made recommendations similar to those in Report BB-72.

Well No. 14, Soladino, drill. BB-77.

Proposed depth of shut-off rejected. Reasons and recommendations similar to those in reports BB-72 and BB-78.

Well No. 39, Soladino, drill. BB-71.

Approval of proposed shut-off withheld until company furnished facts to show why shut-off should be made at the depth as proposed.

Well No. 40, Soladino, shut-off. B-73.

Shut-off satisfactory.

Doheny Pacific Petroleum Co.

Well No. 40, Soladino, bridge and additional shut-off. BB-82.

Proposal to bridge and cement string of 10" casing in order to shut off water entered after drilling below point of shut-off covered in report B-73, approved.

Well No. 1, Lease 1, shut-off. B-48.

Shut-off satisfactory.

Well No. 2, Lease 1, shut-off. B-70.

Shut-off satisfactory.

Well No. 2, Lease 1, cement additional casing. BB-93.

Proposal to bridge and cement a string of 10" casing, in order to make a shut-off stratigraphically uniform with shut-offs in the adjoining wells, approved.

Well No. 3, Lease 1, drill. BB-76.

Recommendations on proposed depth of shut-off withheld until the company furnish this department with the logs of completed wells on Lease No. 1.

Well No. 3, Lease 1, drill. Supplementing Report BB-76.

Logs required in Report BB-76 received by this department, and proposed depth of water shut-off approved.

Well No. 3, Lease 1, shut-off. B-99.

Shut-off satisfactory.

Well No. 4, Lease 1, shut-off. B-63.

Shut-off satisfactory.

Well No. 4, Lease 1, shut-off. B-74.

Shut-off satisfactory.

Well No. 5, Lease 1, shut-off. B-82.

Shut-off satisfactory.

Well No. 6, Lease 1, drill. BB-74.

Recommendations on proposed depth of shut-off withheld until the company furnished this department with the logs of all completed wells on Lease 1.

Well No. 6, Lease 1, drill. Letter supplementing Report BB-74.

Logs required in Report BB-74 received. Proposed depth of shut-off approved.

Well No. 7, Lease 1, shut-off. B-81.

Shut-off not entirely satisfactory. Well passed for drilling into productive formations with recommendation for one month's pumping test.

Well No. 7, Lease 1, shut-off. B-94.

Shut-off satisfactory. Cemented additional string of casing account of small amount of water. See Report B-81.

Well No. 10, Lease 1, drill. BB-75.

Recommendations on proposed depth of shut-off withheld until the company furnished this department with the logs of all completed wells on Lease No. 1.

Well No. 10, Lease 1, drill. Letter supplementing Report BB-75.

Logs required in Report BB-75 received. Recommended shut-off in suitable formations at depth between 900 to 950', instead of depth of 1050' as proposed.

Well No. 11, Lease 1, drill. BB-79.

Recommendations on proposed depth of shut-off withheld until the company furnished this department with the logs of all completed wells on Lease No. 1.

Well No. 11, Lease 1, drill. Letter supplementing Report BB-79.

Logs required in Report BB-79 received. Proposed depth of water shut-off approved.

Well No. 14, Lease 1, drill. BB-73.

Recommendations on proposed depth of shut-off withheld until the company furnished this department with the logs of all completed wells on Lease No. 1.

Well No. 14, Lease 1, drill. Letter supplementing Report BB-73.

Logs required in Report BB-73 received. Proposed depth of water shut-off approved.

Well No. 1, Lease 2, shut-off. B-83.

Shut-off not satisfactory. Recommended casing be tested for possible leaks.

Well No. 1, Lease 2, test casing. BB-64.

As per recommendations in Report B-83, superintendent stated that casing was found to be not sufficiently tightened. It was set up a total of 18". Well was

then bailed to bottom, and after standing 12 hours a bailing test showed shut-off to be satisfactory.

Well No. 5, Lease 2, shut-off. B-92.

Shut-off satisfactory.

Well No. 6, Lease 2, shut-off. B-110.

Shut-off satisfactory.

Casmalia Syndicate.

Well No. 2, Arrellanes, redrill. BB-41.

This is old No. 1 well of the Producers Oil and Transportation Co. The proposal of the Casmalia Syndicate to redrill this well and cement a string of 10″ casing was approved.

Well No. 2, Arrellanes, shut-off. B-49.

Shut-off satisfactory.

Associated Oil Co.

Well No. 2, Arrellanes, bridge and cement. BB-95.

This is the Casmalia Syndicate well referred to in Reports BB-41 and B-49. The property was taken over by the Associated Oil Co. The Associated's proposal to plug bottom and bridge and cement a string of 8¼″ casing at 1400′ in order to test for possible bottom water, was approved with the understanding that every effort would be made to redrill this well to old bottom before plugging.

Casmalia Syndicate.

Well No. 5, Arrellanes, shut-off. B-78.

Shut-off satisfactory.

Well No. 6, Arrellanes, shut-off. B-79.

Shut-off satisfactory.

Associated Oil Co.

Well No. 6, Arrellanes, shut-off. B-96.

This is the Casmalia Syndicate well referred to in Report B-79. Shut-off satisfactory.

T. 9 N., R. 35 W., S. B. B. & M.

Punta de la Laguna Rancho.

Casmalia Syndicate.

Well No. 3, S. P. Lease, shut-off. B-86.

Shut-off satisfactory.

Associated Oil Co.

Well No. 3, S. P. Lease, shut-off. B-106.

This is the Casmalia Syndicate well referred to in Report B-86. Shut-off satisfactory.

Casmalia Syndicate.

Well No. 2, S. P. Lease, shut-off. B-20.

Shut-off satisfactory.

Associated Oil Co.

Well No. 2, S. P. Lease, cement and plug. BB-94.

This is the Casmalia Syndicate well referred to in Report B-20. Associated's proposal to cement string of 10″ at 1640′ and plug bottom of hole if there are indications of bottom water, is approved.

T. 9 N., R. 34 W., S. B. B. & M.

Section 19.

Associated Oil Co.

Well No. 21, Peshine, shut-off. B-93.

Shut-off not satisfactory. Recommended that another attempt at shut-off be made.

Associated Oil Co.
Well No. 21, Peshine, shut-off. B-109.
Test for shut-off not satisfactory. Recommended recementing, redrilling, or landing another string of casing.
Well No. 31, Peshine, drill. BB-84.
Recommended point of shut-off at about 1050′ instead of at about 950′ as proposed.

SECTION 20.

Pinal Dome Oil Co.
Well No. 2, Escolle, shut-off. B-22.
Formation shut-off satisfactory.
Well No. 5, Escolle, shut-off. B-114.
Shut-off satisfactory.

T. 10 N., R. 35 W., S. B. B. & M.

Pezzoni Ranch.

Standard Oil Co.
Well No. 1, Pezzoni, shut-off. B-36.
Shut-off reported successful upon statement of superintendent.

Tognozzini Ranch.

Standard Oil Co.
Well No. 1, Tognozzini, shut-off. B-24.
Shut-off not satisfactory. Well passed for further drilling, with recommendation that a string of 8¼″ casing be cemented before permanently entering any productive oil formations.
Well No. 1, Tognozzini, shut-off. B-54.
Shut-off satisfactory.

LOS ALAMOS FIELD.

T. 7 N., R. 31 W., S. B. B. & M.

SECTION 1.

Standard Oil Co.
Well No. 1, Laguna, shut-off. Letter 6/6/17.
The letter requested data on 10″ shut-off in this well. Shut-off not successful.

LOMPOC FIELD.

T. 8 N., R. 34 W., S. B. B. & M.

SECTION 28.

Orcutt Oil Co.
Well No. 2, deepen. BB-51.
Proposal to deepen to increase production approved.
Well No. 2, plug bottom. BB-89.
In deepening another water stratum was encountered, and proposal to plug back to original depth was approved.
Pacific Oil Fields Ltd.
Well No. 5, abandon. BB-27.
Proposal to abandon approved. Work done by Midway Supply Co. under direction of this department.
Well No. 6, abandon. BB-28.
Proposal to abandon approved. Work done by Midway Supply Co. under direction of this department.
Well No. 7, abandon. BB-29.
Proposal to abandon approved. Work done by Midway Supply Co. under direction of this department.

Orcutt Oil Co.
Well No. 8, abandon. BB-30.
Proposal to abandon approved. Work done by Midway Supply Co. under direction of this department.

SECTION 33.

Pacific Oil Fields, Ltd.
Well No. 1, abandon. BB-24.
Proposal to abandon approved. Work done by Midway Supply Co. under direction of this department.
Well No. 3, abandon. BB-25.
Proposal to abandon approved. Work done by Midway Supply Co. under direction of this department.
Well No. 4, abandon. BB-26.
Proposal to abandon approved. Work done by Midway Supply Co. under direction of this department.

ARROYO GRANDE FIELD.

T. 31 S., R. 13 E., M. D. B. & M.

SECTION 31.

B. B. & E. R. Dudley Petroleum Co.
Well No. 5, shut-off. B-89.
Shut-off approved upon statements of superintendent.
Well No. 1, McNee, redrill. BB-49.
Proposal to redrill approved.
Well No. 1, McNee, shut-off. B-62.
Shut-off satisfactory. Work carried out as per recommendations in Report BB-49.
Well No. 1, Muchado, deepen. BB-36.
Proposal to carry oil string 75′ deeper approved.

East Puente Annex Oil Co.
Well No. 6, Tiber, shut-off. B-28.
Shut-off satisfactory.

T. 32 S., R. 13 E., M. D. B. & M.

SECTION 6.

Louis Titus.
Well No. 1, shut-off. B-77.
Prospect well. Shut-off satisfactory.

SECTION 18.

Highway Oil Co. (J. E. O'Donnell.)
Well No. 1, shut-off. B-97.
Prospect well near the town of Arroyo Grande.

BRADLEY FIELD.

T. 24 S., R. 10 E., M. D. B. & M.

SECTION 36.

Associated Oil Co.
Well No. 1, King, deepen. BB-68.
Prospect well. Proposal to deepen to 1500′ approved.

PARKFIELD.

T. 23 S., R. 14 E., M. D. B. & M.

SECTION 8.

W. W. Garland.
Well No. 1, deepen. BB-62.
Prospect well. Proposal to deepen approved.

SARGENT FIELD.

T. 11 N., R. 4 W., M. D. B. & M.

SECTION 31.

Gilroy Oil Co.
Well No. 6, deepen. BB-23.
Proposal to deepen approved.
Well No. 7, shut-off. B-26.
First test not satisfactory. Well was then bridged below point of shut-off and upon bailing was found to be dry. Shut-off passed upon statement of superintendent.
Well No. 7, abandon. BB-53.
Proposal to abandon and convert into a water well approved.
Well No. 8, abandon. BB-55.
Proposal to shut-off water from oil sands with cement plugs and pull pipe approved.
Well No. 10, shut-off. B-58.
Shut-off passed as satisfactory upon statements of superintendent.
Well No. 11, shut-off. B-59.
Formation shut-off passed as satisfactory upon statements of superintendent.
Well No. 12, shut-off. B-75.
Shut-off satisfactory.

MISCELLANEOUS.

T. 3 N., R. 3 W., M. D. B. & M.

SECTION 4.

Wm. Hauhuth.
Well No. 1, commence drilling. Notice.
Prospect well near Vallejo, Cal.

CHAPTER IV.

KERN COUNTY.

By R. N. Ferguson.

ORGANIZATION AND DISTRICT.

The past year has been essentially a year of growth in both the office force and in the method of handling the work of the department in this district. The year began with Deputy Supervisor Chester Naramore, alone, in charge of a district embracing the McKittrick, Midway, Sunset and Kern River fields. Much credit is due Mr. Naramore for his pioneer work in this field. In this work, he established the department on a friendly basis with the operators and furnished us practically complete records of the operations during the previous year in the district, together with much technical information.

Late in July, 1916, the writer was appointed inspector under Mr. Naramore. On account of additional help, the district to be handled from the Taft office was enlarged on September 12 to include all territory in the San Joaquin Valley south of the south line of Township 22 South, and including the Carrizo and Cuyama country. This brought the Belridge and Lost Hills fields into the district and added materially to the work of this office. Mr. Naramore resigned from the department October 1, 1916, to accept appointment as Chief Petroleum Technologist for the U. S. Bureau of Mines. The writer was appointed Deputy Supervisor to fill the vacancy.

On October 3, 1916, Mr. R. D. Bush was appointed to the Taft office as Inspector to handle the work of the McKittrick, Lost Hills and Belridge districts, which position he held until he received the appointment to the office of Deputy Supervisor at Coalinga during the latter part of February, 1917.

On October 5, 1916, a branch office was opened at Bakersfield with Inspector G. McGregor in charge. This greatly facilitated the work of the department in the Kern River field.

GENERAL SUMMARY.

During the year harmonious co-operation between the operators and this department has prevailed in most cases. The department has at all times stood ready to meet the operators half way in arriving at an understanding where differences of opinion have developed. Such differences are unavoidable where proposals are hastily gotten up and often omit information of vital importance. Such omissions put the department in the position of either having to send out and investigate the history of the well in question, or of assuming that it is in the

worst possible condition. In the rush of handling work that has come before us, it has been impossible to follow the former course, and consequently we have, in many cases, written decisions which aimed to cover every conceivable condition which might affect the well.

In most cases, this procedure has had the desired result of causing the operator to furnish further facts of the case. It has been our experience that when all the facts are brought out in a case there is very seldom any difference between the deductions drawn from them by this department and those drawn by the operators after they have studied the facts.

The most serious misunderstandings that we have had have resulted from failure of the operators to take up their side of questions with us before doing the work. It can readily be seen that a statement that some work we have specified is unnecessary, in view of certain facts, would appear in better light to us if made before instead of after the work has been completed.

The increased force has enabled this department to do the field work in greater detail. In the Kern River field, it has been possible to keep in touch with the important repair and abandonment jobs in addition to the regular work of witnessing tests of shut-off and the incidental office work. In the remainder of the fields some critical cementing jobs have been witnessed, and many fluid level measurements have been made, in addition to the routine work.

In order to accomplish this, it has been necessary in certain cases to pass tests of shut-off without a visit by an inspector. The majority of such cases have been passed on the report of the operator that no satisfactory bailing test could be made. In territory known to be free from "top" water, other tests have of necessity been passed without inspection and in some emergency cases written reports of tests by the operators have been accepted in lieu of inspection.

An active drilling campaign continued throughout the year in this district. There were 467 new wells started, exclusive of those in Lost Hills and Belridge, as against 276 new wells in the same district during the preceding year. In the Lost Hills and Belridge fields which have been in this district since October, 1916, there have been 171 new wells started during the fiscal year, as against 108 for the preceding year.

The following table will show the work that has been handled at the Taft office during the year:

NOTICES AND DECISIONS.

Kern County.

Field	Wells begun	Wells abandoned	Wells redrilled or deepened	Wells tested for water shut-off	Work witnessed
Lost Hills	92	3	48	60	
North Belridge	4	2	8	17	
Belridge	74	5	4	44	
Wild Cat Territory	1	2		2	
McKittrick Front	7	1	6	27	1
McKittrick	40	12	20	34	
Midway	298	34	135	279	19
Sunset	56	21	57	68	10
Kern River	66	19	82	98	
Total Taft District	638	99	360	629	30

The number of wells in this district and the number of logs on file are shown by the following tabulation. Graphic logs are being drawn as fast as possible. The number already completed is also shown in the tabulation:

Field	Number wells	Number logs	Graphic
Lost Hills	420	317	4
North Belridge	24	14	5
Belridge	216	170	1
McKittrick	561	315	88
Midway	2,246	1,542	588
Sunset	743	296	102
Kern River	2,426	1,749	310
Wild cat	23	3	
Totals	6,659	4,406	1,098

Peg models covering about 6500 acres, or 12% of the proved land in the district, have been constructed. The proved area in the district, as shown by the list prepared for assessment purposes, is 56,122 acres.

In the work of testing wells and witnessing mudding and cementing operations, approximately fifty thousand miles of automobile travel has been necessary. While this may give some idea of the amount of outside work handled, it has no bearing on the important phase of our work, that of compiling the information submitted to us in such form as to enable us to give intelligent consideration to the various problems with which the operators are confronted.

The compilation of information and consideration of problems necessitates a detailed knowledge of underground structure which can

only be gained by careful use of all available information in the form of maps, drawings, peg models, and tabulations. Much of the information on which work must be based has been slow in coming in, and consequently, we have not had complete information on any very large area. The areas in which completed work has shown valuable results are covered in detail in following paragraphs.

In some areas the work has not progressed to a final stage, either because of lack of data or lack of time. At the close of the year, better progress is being made than at any time so far, and the idea is being kept steadily in view of eventually working out in detail the geological structure of every part of each field.

SUNSET FIELD.

MARICOPA FLAT AND THIRTY-FIVE ANTICLINE.

Early in the year, the question of methods of producing the gusher sands, and at the same time protecting the upper sands in the Maricopa flat, was put up to this department. The problem had many angles which it is no part of this report to go into, but the prime need in working it out was for detailed knowledge of the underground conditions. Under Mr. Naramore's guidance, a small peg model was constructed which helped very materially in getting a correct understanding of these conditions. This area embraces Sections 31, 32 and 33, Township 12 North, Range 23 West, and Sections 4 and 5, Township 11 North, Range 23 West, S. B. B. & M., and represents the north limb of the "Thirty-Five" anticline in the Sunset field.

The bureau was fortunate in having the co-operation of a number of progressive operators in this district. Information was at all times freely exchanged, and, while at the start there was some disagreement as to the conclusions, the close of the year found practically all operators and this department in accord as to the sequence of beds and the correlations between wells and properties.

The general geology has been well described in Bulletin No. 406, U. S. G. S., and it is merely necessary here to go more thoroughly into the details of oil and water zones encountered from the surface downward. Typical wells show from 500 to 1000 feet of porous water-bearing formation. Below this, blue clays and shales predominate to the first productive sand of "Zone A". Above "Zone A", a comparatively shallow tar sand is frequently reported, but the occasional sands in the blue beds are generally logged as water sands. In drilling to produce the top sand of "Zone A", it has been found necessary to shut off water very close above the oil. This "Zone A" sand has not been generally produced from on account of the difficulty

of locating it in the ordinary manner of drilling, with a hole full of water. It frequently makes no showing whatever.

In order to definitely locate the "Zone A" oil, two things are necessary: First, it is essential to have the top water shut off when the sand is entered; second, it is essential that the hole be tested by bailing before it has penetrated the upper intermediate water which lies very close below. Between the two necessities, the operator is not allowed much leeway as the zone is seldom over 50′ in thickness. Many wells have been unintentionally drilled through the sand by very careful operators. Wells producing from this sand average better than 100 bbls. per day of from 19° to 22° (Baumé) gravity oil.

The upper intermediate water lying just below this "Zone A" oil is, or was originally, a flowing water in the eastern portion of the area. Fortunately, it is separated from the oil by solid and impervious shells, which fact alone makes it possible to produce the oil without letting the water in. The areal extent of this water-bearing sand is not exactly known. The latest information indicates that towards the west the same sand carries oil at least along and near the axis of the anticline, and it is probable that it originally carried oil over a much greater area and that the water now occurring in it is an "edge water".

Below the water above described is the second oil, an oil of slightly higher gravity and equal productivity. Only a few wells have produced this oil, owing perhaps to the difficulty of finding it. In early drilling it was usually encountered while the hole was open to the flowing water which rendered it almost impossible for the oil to show. This has been termed the "Kinsey" sand. It was encountered in Well No. 1 of the Midway Field Oil Company, Section 4, T. 11 N., R. 23 W., S. B. B. & M. at about 2767′ and showed oil of 24° (Baumé) gravity. A number of wells drilled at an early date do not properly protect this sand, and it is undoubtedly being damaged to some extent by the flowing water just above it.

Below the Kinsey sand is a considerable thickness of loose shale in which it almost impossible to make an effective cementing job. These shales show oil at irregular intervals but no pronounced or continuous sand. One of the most persistent beds found is the tar sand just below these shales. It is logged in practically every well drilled to its depth and seldom fails to show up prominently. Attempts to produce this tar sand have universally failed. No production higher than 20 barrels of 10° (Baumé) gravity oil has been reported.

Immediately below the tar sand lies the "big flowing water" sand. This sand is coarse and the flow from it in early days was in some

cases phenomenal. The tar sand and the "big flowing water" converge towards the axis of the anticline and there is evidence tending to show that they actually meet at least an one point. At this point a well encountered the tar sand but did not log the water sand. Attempts to produce from the tar sand finally brought water into the well presumably through the tar sand. This established the belief that the two sands had merged leaving the tar occupying the sand to the exclusion of the water.

Under the "big flowing" water there is about 50 feet of formation in which it is impossible to make a shut off, but solid formations occur below in which a shut-off is easily obtained.

The "gusher sands" which are more or less lenticular lie next below. It has been generally conceded by the operators that there are three of these sands but our work indicates a greater number.

The first of the "gusher sands" is generally called the "Wilhelm" sand. This sand was encountered in some of the earliest drilling. Midway Fields Oil Company Well No. 2 seems to have encountered it at a depth of 2982 feet but our records are fragmentary and do not show the overlying tar or flowing water sand, and consequently, our correlation can not be positive. Union Oil Company Jergins Well No. 1 evidently encountered the sand at from 3188 feet but did not get a good test on account of the failure of cement to set in cementing the 4½" casing at 3182 feet. Union Oil Company International Well No. 2 was drilled just through this sand from 3140 feet to 3152 feet but did not get a positive test owing to complications above that point. The "Wilhelm" sand seems to have been quite generally produced from on Section 32, T. 12 N., R. 23 W., S. B. B. & M., and is reported to have received its name at a well of the Maricopa Star Oil Company on that section.

The data available to the State Mining Bureau indicates the presence of an oil sand about 60 to 70 feet below the "Wilhelm" sand throughout portions of the district. This sand, according to our correlations, is the one from which Well No. 1 of the Lakeview No. 2 Oil Co. produced while gushing, and from which International Well No. 4 of the Union Oil Company produces. In Union Oil Company International Well No. 5, it is logged as a water sand and the indications are that edge water is encroaching along it.

About 60 feet lower is a third sand which is generally called the "Trojan" sand from having been discovered in Trojan Well No. 1, Section 32, T. 12 N., R. 23 W., S. B. B. & M. According to the information in the files of the State Mining Bureau, this sand is being produced from in the following wells on Section 4, T. 11 N., R. 23 W., S. B. B. & M.: Union Oil Co. International Wells No. 3 and No. 5, Interstate

Oil Co. Wells No. 4 and No. 10, Lakeview No. 2 Oil Co. Wells No. 3 and No. 7, and it is recorded in the log of Union Oil Co. Jergins Well No. 1.

Several lower sands are recorded in Midway Fields Oil Company Well No. 3, and Well No. 4 of the Interstate Oil Company apparently gets its production from one of these.

It can be seen from the foregoing description that to produce from the gusher zone, and at the same time protect the shallow sands from both top water and the two intermediate waters, is a difficult problem. To have followed the accepted method of landing pipe above and below each water would have reduced the possibility of getting to the gusher sands because it would have required six strings of casing. Of these, the largest would throughout a large portion of the territory have to be from 2500 to 2800 feet in length.

Bearing in mind that some operators do not admit the existence of the top oil sand and that, even with the most careful drilling, it is difficult to locate definitely, the impracticability of continuing the policy of protecting all oil sands with casing is evident.

To meet the requirements of this particular locality Deputy Naramore suggested a method which is a modification of the mud-laden fluid method, and is outlined in the following letter, dated September 23, 1916, addressed to the State Oil and Gas Supervisor:

"The method of procedure approved by this department for the drilling of the International No. 5 well of the Union Oil Co. on Section 4, 11/23, is as follows:

"For ready reference we have divided the formations into zones, A, B, C, D, and E.

"After passing 2700 feet the company is to keep this office apprised of the log to ascertain if possible the exact depth of the top sand. This sand is listed as 'A'. The Union Oil Co. has failed to locate this sand in wells Nos. 2, 3 and 4. If located, it is to be thoroughly mudded before drilling further. It is expected somewhere between 2730 and 2750.

"The hole is then to be drilled through the first flowing water sand, 'B', expected between 2780 and 2850. The tools are to be stopped after passing through this water sand and the mud is to be circulated, then shut in at the top to force mud back into this water sand until the pumps are stalled at a high pressure, 700 pounds or more.

"Then drilling is to be resumed through zone 'C', and a careful watch kept for a showing of the 24° Be. sand between 2800 and 2900. This sand is recorded in Lakeview and Interstate 1, 2 and 3, and not in 4, 5, 6 and 7. It shows in old Coronation No. 1, but not in International 2, 3 and 4 on the same property.

"If found, this sand should be thoroughly mudded in same manner as described above for zone 'B'.

"Zone 'D', a tar sand, is logged as such in Lakeview Number Two wells Nos. 1, 3, 4 and 7 and in Union wells Nos. 2 and 3. If found, it should be mudded as above zones before cementing. With formations thus mudded up the very best possible results are to be expected with the cementing. In this job 600 sacks of cement are to be used which may reasonably be expected to raise a solid concrete plug high above the highest oil shows. This method will undoubtedly not only keep the water off of the oil but will prevent any migration of any fluid whatsoever, in all of the zones so treated. Moreover, in handling the sands in this sequence the oil sands are mudded before being exposed to the flowing waters.

"After the big cement plug is set and 'holed' through and tested by this department the hole is to be drilled through Zone 'E'.

"Zone 'E'. This is the second flowing water sand and is logged in Lakeview Number Two wells Nos. 1, 3, 4 and 7 and in Union wells Nos. 3 and 4.

"After drilling through this sand, which is expected between 3080 and 3120, it should be thoroughly mudded as above and then the second string of casing cemented at approximately 3150 feet. Enough cement should be used to insure its reaching up into the bottom of the first string, thus effecting a double shut-off.

"This method will thoroughly protect each formation, providing the work is carefully done at each stage and it will care for the water sands in exactly the same manner in which Mr. Stone, the drilling foreman for the Receiver, is using at the present time on wells on Section 32, as reported to me in recent conferences.

"There is much room for discussion on this problem but facts speak loudly when one reviews the wells that tried to use a separate string of casing for each sand. Lakeview Nos. 1 and 3 and Union Nos. 1 and 2 all have been monuments of expense and are still incomplete or abandoned."

This brought about considerable discussion by the operators who finally submitted written opinions on the subject to the Bureau. In answer to these, the State Supervisor ruled as follows under date of November 28, 1916.

"It seems desirable that a definite policy be established with reference to drilling new wells in the Maricopa Flat so as to uniformly protect the various sands from water.

"I have your letter of November 2d covering this subject as it was discussed at a meeting of operators. I have also read the summary of their arguments as given in a circular letter by Mr. F. B. Tough, of the K. T. & O. Co. Letter of Mr. C. H. White of Lakeview No. 2 Oil Co., dated November 21st, has also been carefully considered on account of its clear statement of reasons for and against the method proposed. Letter of A. J. Pollak of the Miocene Oil Co., dated November 23d, is at hand but is merely an expression of opinion, without reasons or references.

"In view of the above discussions and our own observation in that vicinity, the following plans should hereafter be followed:

"Where the distance from the top oil sand to the one which it is proposed to produce from is not more than 400 feet.

"1. Set a string of 10" casing above the top oil sand at a depth specified by this department, cement, and test as usual.

"2. Carry 8" casing through various oil and water sands, using mud under pressure to shut off each sand as encountered, land the casing above the oil sand from which it is proposed to produce, at a depth specified by this department, and put in enough cement to cover all sands encountered below the 10" casing. The work of placing this cement must be witnessed by a representative of this department. The shut-off must be tested in the usual manner.

"When the distance from the top oil sand to the sand from which it is proposed to produce is more than 400 feet, the following plan should be followed:

"1. Land a string of casing, 12½" or larger, at a depth of 400 to 800 feet, or in other words, below the loose formations found comparatively near the surface. This string of casing, serving as a conductor, should be cemented.

"2. Set a string of 10" casing below the top oil sand, at a depth specified by this department, less than 400 feet above the point where the next smaller string of casing is to be landed. The 10" casing must be so handled as to force mud, under pressure, into each sand as it is encountered and enough cement must be put back of the casing to cover all sands up to and including the top oil sand. This cementing must be witnessed by a representative of this department and the usual test of shut-off must also be made.

"3. Carry 8" casing through the various oil and water sands, using mud under pressure to shut off each sand as encountered, land the casing above the oil sand from which it is proposed to produce, at a depth specified by this department, and

put in enough cement to cover all sands encountered below the 10" casing. The work of placing this cement must be witnessed by a representative of this department, and the shut-off must be tested in the usual manner.

"You will please be guided by the foregoing rules in all your decisions in that vicinity. These rules will not be altered unless definite facts and results as to mechanical operations are formally presented to this department in such form as to show an improvement."

It has been found that Method No. 1, which requires a shut-off above the top oil, is the most satisfactory in this district for two reasons:

First. It enables the operator to definitely locate the top sand, which in turn gives him valuable information on where to expect the underlying formations.

Second. It brings the points of shut-off in formations in which it is possible in nearly every case to secure a satisfactory shut-off.

BELRIDGE FIELD.

Mr. Bush, while at the Taft office, did some more or less detailed work in the Belridge District. It was thought at that time that a contour map of the oil sands would be of value, and to that end an effort was made to so correlate the sands as to furnish the necessary data. Owing to peculiar conditions existing there, this was found to be impossible, but it was finally found possible to contour the top of the brown shale with very good results.

The work done in that field shows that the shallow oil lies above the brown shale in a number of sands which are separated by blue shales. It also shows that these sands and blue shales lie unconformably on the brown shale, and that the contact surface is roughly anticlinal in form. This should not be construed to mean that we have exact knowledge as to the dip and strike of the individual beds of the brown shale, for we have not. The overlying sands and blue shales form a broad flat anticline over this irregular ridge of brown shale, but only the upper sands are continuous.

An interesting feature, probably the direct result of this condition, is that the gravity of the oil produced is controlled roughly by the proximity of the oil sand to the brown shale. Those sands immediately on the brown shale carry oil as high as 33 degrees Baumé gravity, and from this the gravity ranges to 14 degrees and lower, with distance from the shale.

WATER CONDITIONS.

"Top" water is present on the flanks of the anticline and probably in small quantities near the apex. This water is easily controlled.

The most serious water condition is that due to the occurrence of water in the outer edge of the field, which is either from an "edge water" condition in the lower portions of producing sands, or from lenticular beds

of water sand. This condition has only recently been discovered, and it is being met promptly by the operators as it develops. In handling this, mud and cement are used behind the pipe to seal off all oil strata through which the pipe passes, in case it is desired to produce below the sand carrying the water. Wherever a satisfactory production can be won from above such a sand, the practice is merely to treat it as "bottom water" and finish the well above it.

LOST HILLS FIELD.

Owing to the great distance from Taft, it has been impossible to give this field the detailed attention it deserves. Our work has been principally that of keeping in touch with the operations of a few active companies.

The structure of the field is that of an anticline, plunging to the southeast. The southeast end of the field is the most completely developed and has been previously described in various publications. Recent development has been towards the northwest, where, owing to the plunge, the productive formations are found at comparatively shallow depths.

Over a large area in the northwestern portion of the field it has been found possible on account of the plunge having eliminated the top water sands, that are found to the southeast, to produce clean oil from shallow sands with the use of only one string of pipe. In this area some rapid development has taken place, mainly, if not entirely, on the northeast flank of the fold.

In the territory positively known to be on the northeast dip no serious water trouble has developed. Along a narrow strip at the southwest edge of the developed area a shallow water-bearing sand has been encountered. Fortunately, a fair production can be won from the sands overlying the one affected and the practice now is to finish the wells above it or, in the case of older wells, to plug back and rely on the upper sands for production.

The information available to the State Mining Bureau does not show conclusively the structural condition to which this occurrence of shallow water is due. It has been quite generally conceded that this water occurs only on the southwest flank of the anticline and as an "edge water." There is, however, some reason to believe that the axis of the anticline may lie farther to the southwest than was generally supposed, and that the water may be the deeper water stratum known towards the northeast, brought up by a sudden steepening of the dip of the beds as the axis of the anticline is approached. Should this latter prove the correct explanation, there would seem to be a possibility of the existence of a separate productive area not yet developed on the southwest limb of the anticline.

KERN RIVER FIELD.

The largest area in which we have had a working knowledge of the structure is the Kern River Field. This has been due to the simplicity of the underground conditions rather than to our having done any great amount of detail work.

The field lies in the southwestern limb of a broad anticlinal spur, which seems to branch out from the Sierra Nevada foothills along the mouth of the Kern River Canyon. So far as our work is concerned, the field may be considered a monocline with a gentle dip to the southwest. The dip varies only slightly in different portions of the field. In the southwest quarter of Section 33, T. 28 S., R 28 E., M. D. B. & M., the dip has been determined to be approximately 6.5 feet per 100, to the southwest. One mile south from Section 4, T. 29 S., R. 28 E., it has been determined to be about 7.5 feet per 100, south 50° west. In Section 5, T. 29 S., R. 28 E., the west component of the dip has been determined to be 6.1 feet per 100; the south component, and consequently the true direction and angle of the dip, has not been exactly determined. Further work to the west may show a steepening of the dip and possibly a change in the strike to a direction more nearly north and south.

The logs of the field show a general similarity, but no continuous marker has as yet been found that can be used as a guide in correlating. One "rule of thumb" by which the point of shut-off has been determined in much of the drilling is that it should be made below the second tar sand. Had this been uniformly followed, the field would undoubtedly have been in much better condition than it is today. Judging from the logs it would appear that the sands and clays are lenticular. This we know to be true to a certain extent, and yet we believe that had the logs been more accurately kept, considerable regularity of beds would be shown.

Throughout the most of the field "top water" is found in abundance but under low head. Owing to the low head on this water, there are portions of the field to which it does not reach and in which wells can be made to produce clean oil with only one string of pipe. Such territory is limited, however, to the higher portions of the monocline, in the extreme northeast edge of the field.

So far as our work has gone, it has not shown any marked structural changes that would be expected to limit the productive area. To the south and west it appears that the drilling has reached a point where water occupies certain sands that higher up carry oil. This condition can neither be proven nor disproven until the irregularity of "shut-offs" in many edge wells is corrected.

There are theories that the water menacing the production of the field is all top water, and theories that it is all bottom water, and there

are some convincing arguments on both sides. It is argued that the fact that certain deep wells, now known to have water in the bottom sands, originally produced clean oil, proves that the water has been let into the sands from above. This is possible, but it neglects the possibility of encroaching "edge water."

On the other hand, it is argued that if the water were coming from the top sands, with the great number of wells with leaking water strings and abandoned wells with no pipe left, and the offsetting wells with water strings landed hundreds of feet stratigraphically nonuniform, there would be nothing but water produced in the field.

This Department has not gone extensively into these theories. It has been content to know that when the deep wells are plugged in every clay or shale stratum from the original bottom back until the well ceases to produce water, the value of the well to the owner has been increased many fold and that the possibility of the well being a source of damage has been eliminated.

Similarly, when it has been believed by the operator that it was necessary, in order to shut water out of the production, to land the water string below sands that were known to carry clean oil in other parts of the field, the Department has ruled that all sands below the point of uniform shut-off should be mudded thoroughly and cemented by forcing sufficient cement behind the water string to reach top sand so mudded.

By these means we are reasonably certain that the water will be confined to its present strata, and if the offending wells are ever so treated, it can be confined to its original strata, except in the case of an encroaching "edge water."

In following out this policy, we would like to see the unplugged abandoned wells treated first. Unfortunately, they will probably be the last ones to be repaired, and we expect that much work will be done that might not have been necessary had the original offenders been taken care of first. However, the uncertainty of finding the original offenders, together with the certainty of getting the cost of the work back out of any well in which water is shut off, we think justifies our policy.

Another policy that might be mentioned is that of plugging the relatively few bottom-water wells before undertaking the correlation of the trouble due to nonuniformity of "shut-off." This is merely to eliminate the smallest class of trouble makers, in order to simplify the proposition of finding and correcting the others.

The correlation of nonuniform "shut-offs" is a matter that will call for more and more attention as time goes on. At present, the most promising method is that of spudding down alongside the old well to the proper point of "shut-off" and thoroughly mudding the formations at that point.

COMPLAINTS.

SUNSET MONARCH OIL COMPANY, Sec. 26, T. 12 N., R. 24 W., S. B. B. & M.

vs.

AMERICAN OILFIELDS COMPANY, Sec. 32, T. 32 S., R. 24 E., M. D. B. & M.

This complaint was formally initiated on October 9, 1915, and at one time reached the stage where work was commenced on Well No. 5 of the American Oilfields Company by that company.

On November 22, 1915, the Superintendent of the company reported on this work in part as follows:

"In going into the well we were able to get to 1700′ with a little cleaning out, and at this depth we went outside of the 6⅝ casing, showing that it has a hole in it at that depth. The casing seeming to be bad at some distance above this depth, I had the hole filled up, and in going down I went through the casing again at 1667′, which goes to show that it is useless to attempt anything further with the 6⅝ casing that is in the hole at the present time, as the oil sand, which I believe the Sunset Monarch people desire to have protected, is at 2250′. I also used a Jar Down Spear for the purpose of getting vibration, and found some vibration on the top of the casing at 1580′, which looks as though there is a possibility of getting the 6⅝ casing out, down that far.

"I have laid off the crews that I had working on the well until the matter has been gone over, and some conclusion arrived at, as to what the Sunset Monarch would like to have done. In going out through the casing at the depth where I found we actually did go out, it is going to mean the drilling of a new hole down to the point of cementing, and in cases of this kind there is always the possibility of the new hole which we drill, by the time we reach the depth where we would like to cement, being some distance from where the old original hole is located; and to get these two holes properly connected, get the old pipe out of the way that is in them, and cement them off to prevent water from getting into the lower sands, is the problem now to be taken into consideration, which I would like to have you do and advise me as to any conclusions that either yourself, or the Sunset Monarch may reach."

This left the well in bad condition and threw the burden of laying out plans for the correction of the trouble on to the State Mining Bureau. After a preliminary canvass of the situation, it was found that the information furnished by the two companies was not sufficiently complete nor accurate to warrant basing recommendations on it. Some difficulty was experienced in getting the added information necessary and the official logs of the Sunset Monarch wells were not received until December, 1916. A cross section was then made which showed such a complex situation that it was decided to construct a peg model and go into the matter more thoroughly.

On January 22, 1916, letters were written to both companies, asking for histories of the wells in question, and for the production records. The information thus elicited was very meagre.

To complete the peg model it was necessary for the Department to correct the elevations that had been submitted. The work had been completed and a report started when the Sunset Monarch property was taken over by the Standard Oil Company.

A comparison of data with the geological department of the Standard Oil Company developed some differences of opinion as to the extent of a certain water sand indicated on the peg model. By mutual agreement the report was held up pending the result of the drilling contemplated by the new owners. This drilling has furnished some valuable information, and it is now expected that when this is put in proper form it will enable us to make a complete report outlining the work necessary to correct existing conditions.

TRADERS OIL COMPANY, Sec. 23, T. 32 S., R. 23 E., M. D. B. & M.

vs.

INDIAN & COLONIAL DEVELOPMENT COMPANY, Sec. 22, T. 32 S., R. 23 E., M. D. B. & M.

Since reporting on this in Bulletin No. 73, the Department has made an extensive investigation of the water trouble complained of. Very little trouble was experienced in getting the necessary data, and our requests for logs and histories and detailed production reports were promptly complied with by the operators.

A peg model was constructed which served the purpose of eliminating from consideration a large number of wells and narrowing the investigation down to those most likely to be offenders.

On December 28, 1916, the writer reported to the State Oil and Gas Supervisor in part as follows:

"The scope of the examination can be materially enlarged when the logs of the Knob Hill, Kern Crown, Palmer Union, Cheney Stimson, and Burks Wells, in Section 23 become available. Without these I doubt if the trouble can be wholly corrected.

"A good start can be made, however, by beginning on the wells that are known to be in bad shape. First among these, I will put Indian Colonial No. 11, Section 23, T. 32 S., R. 23 E., M. D. B. & M. This well was drilled in 1907, and our log of it shows both top and bottom water. As for the top water, the preponderance of evidence is against its presence in this vicinity.

"There is no record of any attempt having been made to plug off the bottom water and the presumption is that this water has access to the oil sands. I am of the opinion that this well is the source of much of the water which has appeared in a number of wells higher up the dip. Many of these produced clean oil for periods ranging from a month to several years before showing water. Such a condition over a limited area might easily be caused by a bad well. However, it is not likely that this well is furnishing all the water appearing in the district affected.

"The general appearance of the whole situation would rather suggest an 'edge water' condition in one or more of the sands. Were it not for the fact that there are a number of other wells in the district which our records show to be at fault, I would unhesitatingly call it an 'edge water' condition. But even so, it is imperative that all bad wells be repaired before proper measures can be taken to correct such a condition. Furthermore, just such a condition could be produced by several bad wells properly located, and there is no means of telling how much of this trouble is due to bad wells, until they are corrected.

"Another well which appears from our log to be in bad shape is Buena Fe Petroleum Company (Mountain Girl) No. 17, Section 22. The casing has been pulled and there is no report of any attempt to plug off the bottom water.

"Buena Fe (West 40) No. 3 is another well in which bottom water was encountered. Its log makes no mention of any attempt to plug it.

"In addition to these, I find a number of wells that have been plugged by bridging above the water sand. Such plugging has in a number of cases shut the water out of the producing part of the well, but has left it free of access to other sands than the one in which it originally occurred. Among these are: Buena Fe Pet. Co. (Bay City) No. 3, presumably with open hole, from 910 to 975 feet; Buena Fe Pet. Co. (Mountain Girl) No. 13, with 68 feet of open hole below the plug; Indian Colonial Dev. Co. No. 4, plugged at 1316, 1280 and 1125 feet with no record of formation between these plugs. Any of these wells may be contributing to the seeming 'edge water' condition throughout this district.

"A number of other wells are reported in good shape but deserve mention merely to give a history of the trouble:

Indian Colonial Dev. Co. No. 1, drilled in 1908, entered bottom water. This was plugged off and the well produced clean oil for one year, when water broke in again. Attempts to plug off this water indicate that this water came in about 300 feet higher in the formation than the first bottom water;

"Wilbert No. 2, drilled in 1909, and encountered water at about this same place. This was about the same time the upper water broke into Indian Colonial No. 1;

"Wilbert No. 1, drilled during the same year, produced clean oil for three months before showing water. By July, 1911, both Wilbert wells were suspended on account of this water.

"I am of the opinion that the water in these three wells comes from Indian Colonial No. 11, Section 23. The continuous pumping of Indian Colonial No. 1 would be expected to draw the water towards it. Wilbert No. 2 would be expected to find the sand flooded, as it is near Indian Colonial No. 1. The position of Wilbert No. 1 relative to the other three wells, would lend weight to the supposition that the water was drawn to it as a result of its own production. It is possible that dye put in Indian Colonial No. 11 would show conclusively whether any of this water comes from that well. This may be impossible on account of the casing being choked with litter.

"Another preliminary test that might be made is to determine the fluid levels in General Petroleum No. 1, Section 27, T. 32 S., R. 23 E., M. D. B. & M. This well does not report water, but is quite deep and undoubtedly has it. It is not likely that it stands high enough to reach the oil sands as the well is quite near the outcrop. If the mechanical condition of the well permits the determination of the fluid level this point can easily be settled.

"I would advise putting this matter before the various agents of the companies concerned and getting their suggestions and any further facts that they have neglected to give us. If this does not bring out any facts contradicting the records that we have of these wells, I would advise repair work on the following wells:

"Indian Colonial Dev. Co., No. 11, Sec. 23, T. 32 S., R. 23 E., M. D. B. & M.

"Indian Colonial Dev. Co., No. 4, Sec. 22, T. 32 S., R. 23 E., M. D. B & M.

"Buena Fe Pet. Co. (Mountain Girl), No. 17, Sec. 22, T. 32 S., R. 23 E., M. D. B. & M.

"Buena Fe Pet. Co. (West 40), No. 3, Sec. 22, T. 32 S., R. 23 E., M. D. B. & M.

"Buena Fe Pet. Co. (Mountain Girl), No. 13, Sec. 22, T. 32 S., R. 23 E., M. D. B. & M.

"When these wells are put in proper shape, conditions can be watched for a time, and no doubt improvement will result. It is of course possible that natural 'edge water' is encroaching throughout the district, and if so, there will be no doubt of it after these offending wells are repaired.

"A more strenuous repair campaign will be demanded if the trouble proves to be 'edge water', but no recommendations can be made as to this work until the repair work on the wells mentioned is completed and results noted."

The condition of the wells mentioned was brought to the attention of the operators by the State Oil and Gas Supervisor in letter dated January 3, 1917. Mr. L. P. Guiberson, General Manager of the Indian & Colonial Development Company, immediately expressed a willingness to undertake the repair of his company's Well No. 11, and by April 30th a new rig had been built over the well and work well started.

The Buena Fe Petroleum Company and the General Petroleum Corporation furnished additional information on the condition of some of their wells. This information has eliminated certain of the wells as possible sources of trouble. The water level in General Petroleum Corporation Well No. 1, Section 27, T. 32 S., R. 23 E., M. D. B. & M., was reported as being below the oil sands which this investigation is attempting to protect.

The reported work on Buena Fe Petroleum Company (Bay City No. 3), indicated that it was still a possible source of water, but tests made by the company since that time have shown conclusively that the well has not been damaging the producing sands.

The information furnished concerning Buena Fe Petroleum Company (Mountain Girl) No. 13 and No. 17, indicates that both may be in need of repair.

The results of the repair of Well No. 11 of the Indian & Colonial Development Company will determine to a large extent the other work that will be necessary. The work on this well was suspended for some time and it finally became necessary for the State Oil and Gas Supervisor to issue the following formal Order directing that the work be done.

ORDER NUMBER THREE,

BY

STATE OIL AND GAS SUPERVISOR R. P. McLAUGHLIN,

DATED SEPTEMBER 18, 1917,

RELATIVE TO

INDIAN COLONIAL DEVELOPMENT COMPANY, WELL No. 11,

Section 23, T. 32 S., R. 23 E., M. D. B. & M.

"To *Indian Colonial Development Company,*

L. P. Guiberson, its Attorney in Fact,

Producers Guaranteed Oil Company.

It appearing to the supervisor that water in excessive and damaging quantities is at present entering the oil sands of several wells situated within a radius of approximately one-half mile from the quarter section corner common to Sections twenty-two (22) and twenty-three (23), Township thirty-two (32) South, Range twenty-three (23) East, M. D. B. & M., in Kern County, California; and

It further appearing that several oil operators and owners of property situated within said region have filed written complaint of said condition with the supervisor,

said supervisor has caused an investigation to be made pursuant to Section 8, Chapter 718, Statutes of 1915, amended 1917, and has determined that the following conditions exist:

The excessive amount of water is probably due to improper conditions existing at more than one well in the vicinity. It will probably be necessary to repair various wells in order to stop the damage. It appears inadvisable to begin widespread repairs on all wells, but rather to first repair such wells as are clearly maintained in such condition as to afford access of water into the oil sands. After such repairs are made, and the results noted, the other wells may be treated as circumstances may indicate.

The log of Well Number Eleven (11) of the Indian Colonial Development Company, situated in the Southwest Quarter of the Southwest Quarter of the Northwest Quarter of Section Twenty-three (23) Township thirty-two (32) South, Range twenty-three (23) East, has been filed with the supervisor by L. P. Guiberson, signing himself as general manager for said company. The log shows the well to have been drilled to a depth of approximately one thousand five hundred and sixty-six (1566) feet.

The rig was subsequently removed and well has not been pumped for a long period of time. The aforementioned information indicates that water was encountered in the vicinity of and below oil sands known to be productive in neighboring wells. There is no evidence before the supervisor showing that proper plugs were placed in the well in such position as to prevent the flow of such water as was encountered from entering said productive oil sands. It is probable that such flow of water is entering said oil sands.

The condition of said well, as aforementioned, was brought to the attention of L. P. Guiberson, general manager of the Indian Colonial Development Company, by the State Oil and Gas Supervisor in a letter dated January 3, 1917. Said letter further requested that repair work be commenced on the well pursuant to specifications to be furnished by Deputy Supervisor R. N. Ferguson. About January 6, 1917, said general manager called at the office of said deputy supervisor at Taft and signified a willingness to commence said repair work. Under date of February 19, 1917, said general manager wrote to the supervisor stating that a rig had been erected at the well and that certain other work, preparatory to repairing the well, had been completed. The letter further stated that actual repair work would be commenced as soon as possible.

On April 30, 1917, said general manager reported to said deputy supervisor that a depth of seven hundred and fifty (750) feet in the well had been reached with a ten (10) inch bit. Said depth is below the bottom of the ten (10) inch casing, as shown by the log of the well. This indicated that some eight (8) inch casing had been withdrawn from the well.

On May 8, 1917, said general manager reported to said deputy supervisor that a depth of one thousand one hundred (1100)) feet had been reached in the well; that the top of eight and a quarter ($8\frac{1}{4}$) inch casing was found at a depth of eight hundred and thirty-six (836) feet and that the eight and a quarter ($8\frac{1}{4}$) inch casing was swedged open and found in good condition.

Further progress has not been reported to the supervisor.

On August 13, 1917, the supervisor addressed a letter to said general manager, calling attention to reported cessation of work, and suggesting the advisability of presenting a definite showing why a formal order should not be issued.

The foregoing statements show the reason and necessity of repair work at Indian Colonial Well Number Eleven (11), Section twenty-three (23), Township thirty-two (32) South, Range twenty-three (23) East, M. D. B. & M.

The foregoing statements also indicate that repair work has not been diligently pursued by the Indian Colonial Development Company, the operators of said well, notwithstanding the written statements of its general manager that such work would be diligently pursued.

Now, therefore, pursuant to Sections 8 and 11, Chapter 718, Statutes of 1915, amended 1917, it is hereby ordered that the following work be immediately commenced and operations carried on continuously until completion:

First: Redrill or clean out the well to a depth of one thousand five hundred sixty-six (1566) feet, or until it is demonstrated that the original bottom of the well has been reached. If it proves necessary, in order to reach said original bottom of well, mud shall be used between the depths of one thousand three hundred seventeen (1317) feet and said original bottom of well.

Second: The hole shall be solidly plugged and tamped with clay from the original bottom to a depth of one thousand four hundred forty-nine (1449) feet.

Third: From the top of the last mentioned clay plug the well shall be shot with fifty (50) pounds of sixty (60) per cent dynamite and cleaned out to top of said clay plug. Sufficient cement shall then be placed in the hole to fill it to a depth of one thousand four hundred ten (1410) feet.

Fourth: After it is demonstrated that the last mentioned cement plug has been properly set at the specified depth, the hole shall be solidly plugged and tamped with clay from the top of said cement plug up to a depth of one thousand three hundred seventeen (1317) feet.

Fifth: From the top of the last mentioned clay plug the well shall be shot with fifty (50) pounds of sixty (60) per cent dynamite and cleaned out to top of said clay plug. Sufficient cement shall then be placed in the hole to fill it to a depth of one thousand two hundred sixty-one (1261) feet.

Sixth: After it is demonstrated that the last mentioned cement plug has properly set at the specified depth, the well shall be tested by bailing.

All work must be done to the satisfaction of the supervisor.

All demonstrations of required plugging shall be witnessed by the supervisor or his duly appointed representative.

A written report shall be furnished to the supervisor each day by the owner or operator of the well. Said report shall be in duplicate, signed by the representative of the owner or operator of the well, and shall fully and completely set forth all work accomplished during the preceding twenty-four hours, together with the names of all workmen employed at the well within said period of time.

Deputy Supervisor R. N. Ferguson of Taft, California, is hereby appointed to represent the supervisor in so far as it may be necessary to inspect the work and receive reports of same.

Any and all requests for modification of the aforementioned specifications must be made in writing, addressed to the supervisor and delivered to said deputy supervisor. Said deputy shall thereupon forward said request or requests to the supervisor, together with such recommendations as may be deemed necessary."

At the present writing, December 11, 1917, the well is cleaned out to original bottom and the work of plugging will soon be under way. On account of new information, developed in the course of the redrilling some changes have since been made in the specifications contained in the order.

KERN TRADING AND OIL COMPANY, Sec. 30, T. 12 N., R. 23 W., S. B. B. & M.

vs.

NATIONAL PACIFIC OIL COMPANY, Sec. 30, T. 12 N., R. 23 W., S. B. B. & M.

November 17, 1915.

There have been no new developments in this case during the past year, but a better feeling prevails and it is thought likely that work will be started voluntarily during the coming year.

ROCK OIL COMPANY, Sec. 23, T. 31 S., R. 22 E., M. D. B. & M.
vs.
SAN FRANCISCO MIDWAY OIL COMPANY, Sec. 24, T. 31 S., R. 22 E., M. D. B. & M.
January 21, 1916.

Extreme difficulty was experienced in getting information on which to base this investigation. This was true of the plaintiff company as well as the defendant. Cross sections were made which indicated that several wells were at fault. A preliminary report to the State Oil and Gas Supervisor, dated December 20, 1916, recommended that work be started on two of the wells at once.

It was recommended that top water be excluded from Well No. 2 of the San Francisco Midway Oil Company, and that a test of the old job of plugging for bottom water be made. The top water had been let into the well by perforating the water string.

A test of the water string of Rock Oil Company No. 2 was also recommended. Other work was made dependent upon the results of this work. A further investigation was made later under the direction of Deputy M. J. Kirwan, which resulted in the issuance of a more complete set of specifications for the repair of the San Francisco Midway Oil Company wells.

On May 25, 1917, the department witnessed a bailing test on Well No. 2 of the San Francisco Midway Oil Co., which demonstrated that the old job of plugging had successfully shut bottom water out of producing formations. The test was made after top water had been excluded by means of a packer set below the perforations of the $8\frac{1}{4}''$ water string. The department then authorized plugging the well up to the shoe of the $8\frac{1}{4}''$ casing and redrilling to make a higher "shut-off," in order to test the oil showings previously cased off behind the water string. This work has not been completed, and as the results may determine in a measure the work that will be required on other wells, the completion of the investigation is awaiting these results.

In securing information for further investigation of this complaint, it was found necessary to issue the following formal order:

ORDER NUMBER TWO
BY
STATE OIL AND GAS SUPERVISOR R. P. McLAUGHLIN.
DATED JULY 2, 1917,
RELATIVE TO
SAN FRANCISCO MIDWAY OIL COMPANY WELL No. 2.
Section 24, T. 31 S., Range 22 E., M. D. B. & M.

"To *Rock Oil Company,*
San Francisco Midway Oil Company,
Brookshire Oil Company,
Midland Oilfields Company,
General Petroleum Corporation:

It appearing to the supervisor that written complaints signed by more than one-third of the individuals or corporations owning land, or operating wells, within

a radius of one mile of a certain well known and designated as San Francisco Midway Well No. 2, situated in the southwest quarter of the southwest quarter of section 24, T. 31 S., R. 22 E., M. D. B. & M., have been filed pursuant to Section 11, Chapter 718, Statutes of 1915, said supervisor has caused an investigation to be made and has determined that the following condition exists:

Water in excessive and damaging quantities is at present entering the oil sands of several wells within a radius of approximately one-fourth of a mile from the said well.

The excessive amount of water is probably due to improper conditions existing at more than one well in the area mentioned. Relief can only be had by treating all the wells under a single comprehensive plan, for the reason that they are intimately related underground.

The investigation began with the assumption that the damaging conditions complained of originated in and were local to the said well. The owners of said well have performed certain work upon it, with the advice and suggestions of the supervisor. Considerable vital information as to the condition and productiveness of various neighboring wells is not shown by records filed with the supervisor. Failure of the Rock Oil Company, the original complainant, to fully cooperate with informal requests for information, relative to fluid levels and production, has been particularly notable.

It is necessary to perform certain tests in order to more definitely determine the source of the infiltrating water and direct repair work at the wells for the purpose of preventing damage.

Now, therefore, pursuant to sections 8 and 11, Chapter 718, Statutes of 1915, it is hereby ordered that the following tests be made and the following records furnished:

Measurements of amounts of oil and of water must be made at the following wells:

Rock Oil Company wells numbered One (1), Two (2), Three (3), Four (4), Seven (7), and Eight (8) in Section 23.

San Francisco Midway Oil Company wells numbered Two (2), and Three (3) in Section 24.

General Petroleum Corporation well numbered Four (4) "Brunswick" in Section 26.

Midland Oilfields Company wells numbered One (1), and Two (2) in Section 25.

Brookshire Oil Company well numbered Five (5) in Section 24, all in Township 31 South, Range 22 East, M. D. B. & M.

The measurements are to be made at each well separately at least three times for periods of twenty-four hours each. Measurements are to be made within ten days from date hereof and a written statement of the results of all measurements must be filed with Deputy Supervisor R. N. Ferguson, at Taft, California, within fifteen days from date hereof.

The measurement of amounts of oil and of water are to be made by running all fluid from the well into a tank of sufficient capacity to contain all fluid produced in twenty-four hours. Flow into the tank must be maintained continuously for twenty-four hours unless it amounts to more than fifty barrels in which case a shorter period of time will be permissible. At the end of the prescribed period of time, flow into the tank is to be stopped and the total fluid measured. Such free water as may have settled to the bottom of the tank shall be drawn off and the remaining fluid again measured and sampled to determine the amount of water held in suspension, as shown by proper test with centrifuge. Details of the manner of making measurements and submitting statement of results thereof to be subject to the approval of Deputy Supervisor R. N. Ferguson.

Measurements to determine the depths at which fluid stands must be made within thirty days from date hereof at each of the following wells:

Rock Oil Company wells numbered One (1), Two (2), Three (3), Four (4), Seven (7), and Eight (8) in Section 23.

General Petroleum Corporation well numbered Four (4) "Brunswick" in Section 26.

Brookshire Oil Company well numbered Five (5) in Section 24.

Midland Oilfields Company wells numbered One (1), and Two (2), in Section 25.

San Francisco Midway Oil Company well numbered Three (3) in Section 24, all in Township 31 South, Range 22 East, M. D. B. & M. The tests to determine the depth at which fluid stands are to be made by withdrawing the tubing from the well, and, after ten hours from the time the tubing is removed, measuring to the surface of the fluid, measurement to be witnessed by Deputy Supervisor R. N. Ferguson, or a person designated by him for that purpose.

Tests must be made at Rock Oil Company well numbered Two (2) to determine whether or not the eight and one-quarter inch (8¼") casing is leaking water and also whether or not the water shut-off at the bottom of said casing is effective. Manner and date of these casing tests to be subject to written request by Deputy Supervisor R. N. Ferguson.

Complete written records must be furnished within thirty days from date hereof to Deputy Supervisor R. N. Ferguson at Taft, California, for the following specified wells and operations:

Rock Oil Company well number Five (5), method of abandonment; well numbered Two (2), redrilling; both in Section 23.

Midland Oilfields Company wells numbered One (1), and Two (2), in Section 25, record of drilling, all in Township 31 South, Range 22 East, M. D. B. & M.

Further tests and repairs will be determined after completion of the aforementioned tests and measurements and will be covered by a supplement, or continuation of this order."

The tests and information demanded in the order have been made or furnished with the following exceptions:

Rock Oil Co. Well No. 3, not tested on account of lost tubing and rods in the hole.

San Francisco Midway Oil Co. Wells No. 2 and No. 3 not tested.

At the present writing, December, 1917, it appears likely that the more stringent provision of the law will have to be invoked to secure compliance with the order.

PACIFIC CRUDE OIL COMPANY, Sec. 32, T. 31 S., R. 23 E., M. D. B. & M.

vs.

BUICK OIL COMPANY, Sec. 32, T. 31 S., R. 23 E., M. D. B. & M.

No progress has since been made.

NACIREMA OIL COMPANY (Now Pittsburg Oil & Gas Co.)

Sec. 6, T. 30 S., R. 22 E., M. D. B. & M.

vs.

UNITED STATES OIL & MINING COMPANY (Now Nevada County Oil Co.), Sec. 6, T. 30 S., R. 22 E., M. D. B. & M.

While it has been impossible for the department to secure sufficient definite information on which to base recommendations, the normal development of the territory has virtually eliminated the trouble complained of. The Nevada County Oil Company has been diligently

prosecuting the work on the wells complained of and approval has been granted by this department to abandon Well No. 4 (now No. 44) and to redrill Well No. 3 (now No. 43).

We have had no application as yet to work on Well No. 2.

FAIRBANKS OIL COMPANY, Sec. 22, T. 32 S., R. 23 E., M. D. B. & M.

vs.

GENERAL PETROLEUM CORPORATION (Sibyl), Sec. 22, T. 32 S., R. 23 E., M. D. B. & M.

February 25, 1916.

The investigation of this matter was held in abeyance during the tests conducted under Complaint of Fairbanks Oil Company *vs.* Buena Fe Petroleum Co., but in view of the fact that the well tested in that case was shown not to be at fault, it is likely that a further examination into the condition of the Sibyl well will be requested by the Fairbanks Oil Company.

FAIRBANKS OIL COMPANY, Sec. 22, T. 32 S., R. 23 E., M. D. B. & M.

vs.

BUENA FE PETROLEUM CO., Sec. 22, T. 32 S., R. 23 E., M. D. B. & M.

March 7, 1917 (Verbal).

This matter did not reach the stage of a complaint, but as it resulted in the testing of a well which previously appeared to be improperly plugged, it has been so classed for record.

Representatives of the two companies met at the Taft office of the State Mining Bureau on August 15, 1917, and an agreement was reached, to the effect that the Buena Fe Petroleum Co., Ltd., would clean out its Well No. 3 (West 40) to a depth of 1050 feet and make tests of the old plugging between that depth and the bottom water which had been encountered in drilling the well. All the records concerning this old job of plugging showed that the water had not been shut off until the final cementing, which brought the top of the plug up to a depth of 961′, or 42′ inside the unperforated 8¼″ casing. In testing this well, the hole was cleaned out to a depth of 1042 feet and showed only a slow rise of water level after bailing. It was then plugged back to 999′, after which an 8¼″ perforated liner was set in and the 10″ casing perforated from 710′ to 720′.

A pumping test was made on November 27, 1917, with the pump set at a depth of 960′, and after standing 19 hours the well pumped but three barrels of fluid before exhausting the same. This test showed clearly that the well had not been the source of the water complained of.

In making the test, the company was able to salvage the 8¼″ casing.

HALE-McLEOD OIL COMPANY and MIDWAY FIVE OIL COMPANY, Sec. 2, T. 32 S., R. 23 E., M. D. B. & M.

vs.

KALISPELL MIDWAY OIL COMPANY, Sec. 5, T. 32 S., R. 23 E., M. D. B. & M.

March 30, 1916.

Mr. Naramore's work on this complaint, as reported in Bulletin No. 73, showed the troubles complained of to be very complex. Lack of complete records and shortage of time have rendered it impossible for the department to make as extensive an investigation as the conditions warrant.

The abandonment by the Kalispell Midway Oil Company of the well complained of (No. 2), relieved the situation temporarily. The plugging of this well was specified by this department and should prevent the well from being a menace in the future. From the data available at the time of its abandonment, it appeared that the well was getting the water through an oil sand, probably as a result of neighboring wells having had their water strings landed below this sand.

MIDWAY ROYAL PETROLEUM COMPANY, Sec. 19, T. 31 E., R. 23 E., M. D. B. & M.

vs.

BROOKSHIRE OIL COMPANY, Sec. 24, T. 31 S., R. 22 E., M. D. B. & M.

April 3, 1916.

At the urgent request of the Midway Royal Petroleum Company this matter was again gone into. A complete set of production reports of the various wells was secured and plotted, and in order to make this information of value, the two companies were requested to pull the tubing from the wells in question and allow us to determine fluid levels and depths of the various holes.

The Brookshire Oil Company furnished the department the opportunity asked for, at once, and the wells made a very creditable showing.

The Midway Royal Petroleum Company, at whose request the investigation was undertaken on June 14, 1917, failed to furnish the department with an opportunity to make the corresponding measurements on its wells and, consequently, the investigation was discontinued on October 13, 1917.

STOCKTON MIDWAY OIL COMPANY, Sec. 14, T. 31 S., R. 22 E., M. D. B. & M.

vs.

ONISBO OIL COMPANY (Well No. 1), Sec. 14, T. 3 S., R. 22 E., M. D. B. & M.

June 28, 1916.

The department has not yet secured the official log of the well complained of (No. 1), and no attempt at an investigation has been made.

GENERAL PETROLEUM CORPORATION, Sec. 15, T. 31 S., R. 22 E., M. D. B. & M.
vs.
POTTER OIL CO. (Well No. 8), Sec. 15, T. 31 S., R. 22 E., M. D. B. & M.
August 3, 1916.

An investigation of this matter will be made as soon as the work on the earlier complaints is finished.

UNION OIL COMPANY OF CALIFORNIA, Sec. 34, T. 32 S., R. 24 E., M. D. B. & M.
vs.
SOUTH MIDWAY OIL COMPANY, Sec. 34, T. 32 S., R. 24 E., M. D. B. & M.
November 30, 1915.

The South Midway Oil Company property has been taken over by the Lakeview No. 2 Oil Company, and work has been begun on Well No. 23, formerly known as No. 2 or No. 4. Upon completion of the work on this well, it is understood that the company intends correcting the trouble in the well complained of, old No. 1.

AMAUROT OIL COMPANY, Sec. 5, T. 29 S., R. 28 E., M. D. B. & M.
vs.
DEL REY OIL COMPANY, Sec. 5, T. 29 S., R. 28 E., M. D. B. & M.
October, 1915.

The work of satisfying this complaint was practically completed during the previous fiscal year, as reported in Bulletin No. 73. It involved the plugging with clay of the bottom of the well (No. 1) of the Del Rey Oil Company, and recementing the water string of Well No. 2 of that company. The method used is described on page 87 in the article on Mudding Methods practiced in the Kern River field. The results were immediate, and beneficial to all surrounding property, and have proven permanent.

The behavior of the wells of the Del Rey Oil Company before and after the repairs is shown by the following table of daily production:

Well	Before repairs		After repairs	
	Oil (barrels)	Water (barrels)	Oil (barrels)	Water (barrels)
No. 1			7	5
No. 2	10	1,500	40	15
No. 3	40	40	45	6
No. 6	20	25	25	25
No. 7	20	150	45	35
No. 8	15		15	
No. 10	20	15	20	15
No. 11	10	20	10	20
Totals	135	1,750	207	121

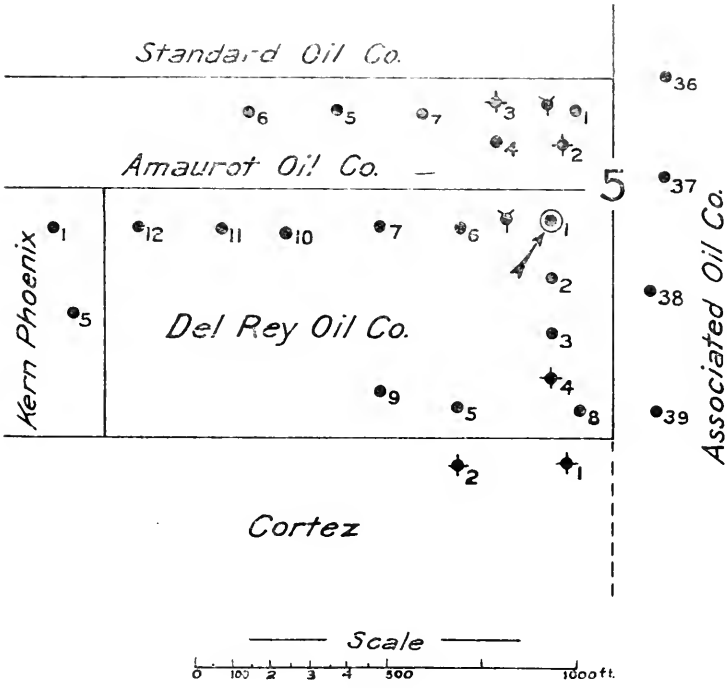


FIG. 23.

This shows that the daily production of oil from the wells was increased from 135 to 207 barrels and the daily production of water reduced from 1750 to about 120 barrels.

The area under investigation has since been enlarged and further recommendations for the correction of troubles in the vicinity have been made and a still further report is being worked on at present.

ALMA OIL COMPANY (Junior Property), Sec. 4, T. 29 S., R. 28 E., M. D. B. & M.

ASSOCIATED OIL COMPANY (Red Bank), Sec. 4, T. 29 S., R. 28 E., M. D. B. & M.

PETROLEUM DEVELOPMENT COMPANY, Sec. 4, T. 29 S., R. 28 E., M. D. B. & M.

The water troubles in this vicinity are of long standing and have withstood several attempts to overcome them.

This investigation was made at the joint request of the above named companies. The brunt of the work for this department fell to Mr. G. McGregor, then Inspector, handling the work of the Kern River field. The result of the investigation was reported to the State Oil and Gas Supervisor on January 8, 1917, and on January 24, 1917, instructions for the repair of certain wells were issued by the Supervisor in the following letter addressed to each of the above companies:

"Relative to the matter of repairing damage being done by water in the vicinity of the Alma Jr. Property in the Kern River field, we have completed a very thorough investigation.

"As the matter now stands, it is certain that both top and bottom water have access to the producing oil sands. To repair the wells that are making bottom water is a simple matter compared to correcting the top water troubles and consequently, we recommend that the bottom water conditions in Alma Jr. No. 2 and Petroleum Development Co. No. 28 be corrected first.

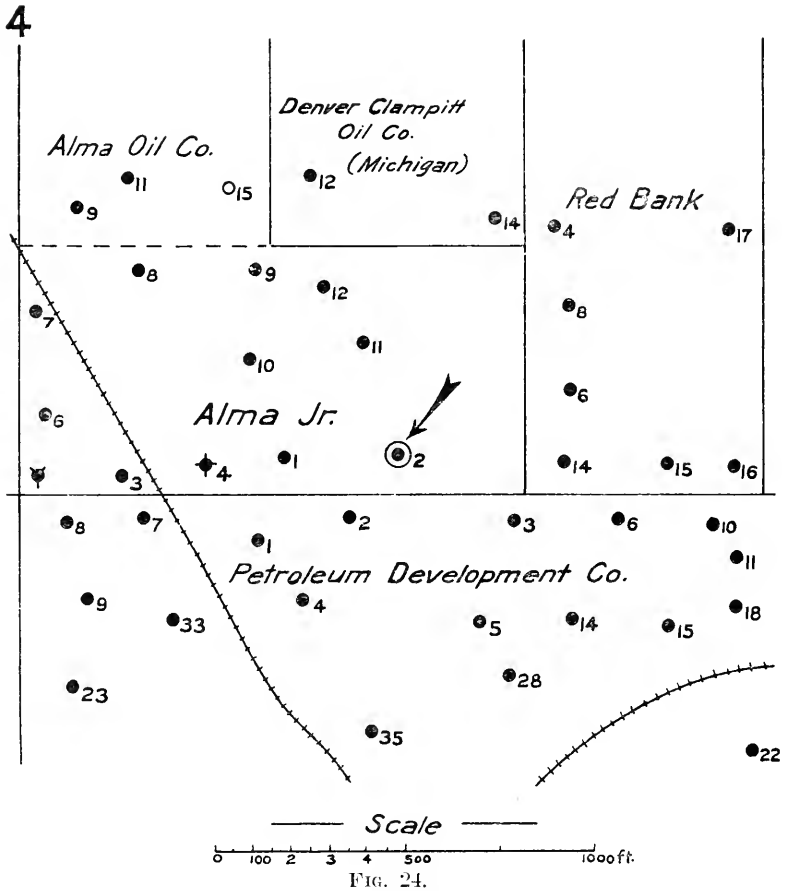


FIG. 24.

"To enable us to make a test on the jobs of plugging for bottom water it will of course be necessary to have top water shut-off. To this end the Alma Jr. Co., should immediately pull the oil string in No. 2, bridge below the point of shut-off, and bail the well for us to test. They should then redrill to original bottom, driving any old casing into the walls, and plug with cement up to 725 feet. When this cement is set, a pumping test will be necessary to determine whether or not the well still makes water. In the event that it still makes the same amount as heretofore, it will indicate that the water is being let in through the oil sands by low shut-offs of surrounding wells, and it should be allowed to stand until the latter condition is remedied.

"Petroleum Development No. 28 should be abandoned and plugged, unless this has already been done and not reported. In the latter case a report should be furnished us at once. A solid plug into the walls of the hole at a depth of 760 feet would

protect the producing oil sands reported in surrounding wells. If the log of Petroleum Development No. 28 is accurate in reporting oil sands to the depth of 900 feet, nothing less than a solid plug against the walls of the hole from 900 to 760 feet would be satisfactory.

"This amount of work alone should materially improve conditions. How much of the trouble it will overcome is uncertain. It is very likely that it will be necessary eventually to establish new points of shut-off in about half of the wells in the district before an absolutely clean production of oil can be secured.

"Among those most in need of such repair are Petroleum Development Company Nos. 3, 10, 13, 14 and 28, Red Bank, Nos. 4, 6, 7, 8, 9, 10, 11, 13 and 14. This will serve to show what an undertaking it would be to establish uniform shut-offs in the district, and that brings up the question of the method to be used.

"Common practice would demand redrilling every well to be repaired, but it occurs to us that some simpler method could be devised that would enable the operators to re-establish points of shut-off a great deal cheaper. We think that some experiments along this line would result favorably.

"Should the result of the work recommended on Alma Jr. No. 2 and Petroleum Development Company No. 28 indicate that the lack of uniformity of points of shut-off are responsible for the water conditions, we recommend that shut-offs be established in Red Bank No. 14 and Petroleum Development No. 14 in conformity with those of the Alma Jr. wells.

"The above conclusions are drawn from a thorough consideration of the question given by Deputy Supervisor R. N. Ferguson and Inspector G. McGregor. These conclusions cover the matter so far as practical needs at the present time are concerned and outlines the work this department expects to see done. However, we shall be glad to later furnish the three companies with a complete report accompanied by drawings, giving the facts upon which the conclusions were based, and in order to comply with the legal requirements governing the manner in which records are maintained as confidential by this department, I would like a written statement from all three companies releasing all of this information to the three companies mentioned."

Release of the confidential information, contained in the report and drawings, to the three interested companies was later obtained and each was furnished with a copy of the report on which the above recommendations were based.

Both the Petroleum Development Company and the Alma Oil Company immediately started work as recommended. The work on Well No. 28 of the Petroleum Development Company consisted of plugging off the deep-flowing salt water well below the lowest oil measures. The work on this well was then suspended, as it was thought that a better test could be made on the success of plugging after the work on Alma Jr. No. 2 was completed, than when the sands were being flooded from that well.

Work was begun on the Alma Jr., No. 2 well, February 25, 1917, when the 3″ air line was pulled and an unsuccessful attempt was made to loosen the 7⅝″ casing. A cement plug was located in the bottom of the 7⅝″ casing at 874 feet. The 7⅝″ casing was finally loosened with two 60-ton jacks, and after raising it one point, the cement in the bottom was drilled out.

An attempt was made to plug the hole as the 7⅝" casing was withdrawn, but was not a success as every movement of the casing caused the hole to fill with sand through the perforations. The 7⅝" casing was pulled, the perforated pipe replaced with blank pipe and the casing run back in. As the sand had to be fought all the way down, this was a slow job and finally, when the pipe was back to about 830 feet, the string of tools was stuck in the hole by caving sand. In an attempt to hydraulic them loose, part of the 1" pipe used was lost.

The drilling line was cut and the next two weeks spent in fishing for the pipe and tools, which were finally recovered April 30, 1917.

On May 1, 1917, Mr. J. E. Beard put the well in the hands of the State Mining Bureau, giving us authority to employ a crew and generally supervise operations. Under this arrangement a drilling crew employed by the Petroleum Development Company was engaged to begin work on the above date, and under the direct supervision of the State Mining Bureau. The Petroleum Development Company granted the men a leave of absence for the period of this work.

After several days' work it was found that it was impracticable to try to mud the hole with the sand heaving in, so the 7⅝" casing was pulled and run back into the hole to a depth of about 702 feet, and the mudding of the well began in earnest.

The system used was to keep the tools swinging at or near the shoe of the pipe, shovelling the clay in dry and allowing a stream of water to run into the well. In this way it was hoped to mud the sands sufficiently so that the pipe could be lowered without danger of freezing. By this method the pipe was carried down to 789 feet, where it froze after about 1000 cubic yards of clay had been put in. The hole was then drilled ahead to 886½ feet, using approximately another 100 yards of clay, and the process of plugging back was begun. The hole was plugged back solid from 886½ feet to 826 feet with clay, cobbles, manila rope, etc. At this depth the well was shot with 30 pounds of 60% dynamite, the hole cleaned out and 15 sacks of cement put in through tubing. A second shot was placed at 792 feet (32 pounds of 60% dynamite) and, after cleaning out to 801 feet, eight sacks of cement were put in through tubing. A third shot was put in from 767 feet to 773 feet (50 pound of 40% dynamite) and the hole was cleaned out to 782 feet. Eleven sacks of cement were put in at this depth through tubing. A fourth shot (50 pounds of 60% dynamite) was put in from 757 feet to 765 feet. The hole was cleaned out to 765 feet and filled with clay and cobbles to 755 feet and a fifth shot put in from 745 feet to 752 feet (50 pounds of 60% dynamite). The hole was then cleaned out to 755 feet and tamped solid with clay and cobbles up to 735 feet, and a shell containing 50 pounds of 60% dynamite failed to explode.

A second shell of the same size was then set on top of the first one and exploded.

Following this the hole was cleaned out to 735 feet and after running water in for several hours 13 sacks of cement were put in through tubing. This cement filled the hole to about 722 feet and the hole was then filled up with cobbles, a heaving plug set at 702 feet, and the pipe was perforated from 684 feet to 702 feet.

While sufficient time has not elapsed since the completion of the work to obtain final figures on its beneficial effects, the present indications are that the job was a complete success.

At present the water handled in the vicinity of this well has decreased from about 16,000 barrels daily to about 250 barrels daily, and the oil output has increased from about 25 barrels daily to approximately 60 barrels daily.

The operation of two compressor plants has been made unnecessary, thereby eliminating operating expense of about $500 per month and also saving about 100 bbls. of oil used as fuel at the plants.

	Daily production before repairs		Daily production after repairs	
	Oil (barrels)	Water (barrels)	Oil (barrels)	Water (barrels)
Alma Jr.—				
No. 1	Trace	150	7	00
No. 2	00	12,000	Trace	100
No. 5	Trace	200	10	Trace
No. 11	Trace	250	7	40
No. 12	Trace	200	10	25
Pet. Dev. (Santa Fe)—				
No. 1	3	32	4	10
No. 2	00	1,440	*	*
No. 6	5	250	4	20
No. 10	5	400	5	10
No. 14	5	5	5	10
No. 18	7	1,000	7	25
Totals	25	15,927	59	240

*Not yet rigged for pumping.

About 1140 yards of clay were used in addition to several loads of cobblestones and other materials. The work extended over a period of six and one-half months, the last four and one-half months of which it was under the supervision of the State Mining Bureau. The cost of the job is shown below.

This Department is greatly appreciative of the spirit of co-operation displayed by Mr. J. E. Beard of the Alma Oil Company, who showed that at all times he was ready and willing to do anything in his power to remedy the existing conditions.

Thanks are also due to Mr. D. T. Saine, superintendent of the Petroleum Development Company, and to his drillers, Messrs. C. F. Fox and

F. McBride, for their hearty co-operation with this department, thus lessening the burden to a considerable extent.

Cost of Repairs on Well No. 2 Jr., Alma Oil Co.

Initial expense from March 1 to May 1, 1917:		
Labor	$292 50	
Lumber	85 05	
Miscellaneous material used	161 23	
Sundry general expenses	48 45	$587 23
Under supervision of State Water Commission, from May 1 to September 17, 1917:		
Labor	$4,151 98	
Lumber	95 00	
Miscellaneous materials used	401 17	
Sundry general expense	182 75	
Hauling clay	2,499 14	7,330 04
Total cost		$7,917 27

VISALIA OIL COMPANY, Sec. 14, T. 32 S., R. 23 E., M. D. B. & M.

vs.

UNION OIL COMPANY OF CALIFORNIA (Regal No. 6), Sec. 14, T. 32 S., R. 23 E., M. D. B. & M.

October 4, 1915.

On the above date complaint was made that the Union Oil Company, in drilling Well No. 6 (Regal), had damaged the property belonging to the Visalia Oil Company and operated by the Union Oil Company under the name of the Bedrock Oil Company.

The history of the well complained of would indicate that for a time it may have let water into the sand from which the Bedrock wells produced. However, since that time it has been deepened and re-cemented in such a manner as to offer reasonable assurance that the top water is excluded from the upper oil sand, as well as the sand from which the well now produces.

A. L. WEIL

vs.

MIDLAND OILFIELDS COMPANY, LTD., Sec. 12, T. 31 S., R. 22 E., M. D. B. & M.

September 7, 1916.

In response to a letter from the State Oil and Gas Supervisor under date of September 7, 1916, a preliminary examination of the property and the records was made to determine the advisability of making pumping tests of the well in question.

This was reported on by letter to the Supervisor, dated September 22, 1916, in which it was stated that there was nothing in the official records of these wells and nothing on the surface of the property to show that the wells were not properly finished.

STATE MINING BUREAU

vs.

OPERATORS ON 25 HILL.

October 5, 1916.

Under the above date letters were written to representatives of the Section Twenty Five Oil Company and the Paraffine Oil Company, stating that the Department expected to be called upon to investigate water conditions on the hill and requesting logs of the wells on certain properties

The department has a surveying crew in the field getting correct locations and elevations of the wells on the above two sections. Upon completion of the survey an extensive investigation of the territory will be made.

T. L. HANNAH

vs.

MARATHON OIL COMPANY, Sec. 24, T. 25 S., R. 18 E., M. D. B. & M.

February 11, 1917.

Complaint was made on the above date that a Mr. C. T. Doherty of the Marathon Oil Company had drilled a well on the above section in which flowing water and oil were encountered, and that no attempt had been made to shut the water off.

The well complained of drilled without notice to the department and, consequently, in violation of the law. Several visits have been made to the well, but each time the place was deserted. The well was drilled with a portable rig.

MIDWAY CONSOLIDATED, LTD.

vs.

WILKES HEAD OIL COMPANY, Sec. 4, T. 32 S., R. 23 E., M. D. B. & M.

This complaint is the outcome of the failure of the Wilkes Head Oil Company to live up to a verbal agreement made by its representatives at a conference held at the Taft office of the State Mining Bureau on October 11, 1915.

At this meeting several operators agreed to make certain repairs on their wells in the general vicinity, and the representatives of the Wilkes

Head Oil Company agreed to begin work on Well No. 1 within ten days. The well had been standing idle many months, with a water sand at a depth of 3330 feet and an oil sand at a depth of 3265 feet cased off behind the 6¼" casing, which had been cemented at 3627 feet. In cementing the 6¼" casing at 3627' two lengths of 6¼" casing had been sidetracked.

The agreement between the operators permitted the Wilkes Head Oil Company to prospect ahead with 4½" casing, seeking a deeper oil. The understanding was that if no deeper oil was found the well would be plugged back and abandoned in such a manner as to shut the water at 3330 feet out of the oil at 3265 feet.

On January 18, 1916, this department witnessed a test of the 6¼" casing showing that it had been successfully cemented.

No approval to do any further work on the well was given by this department, but our information is to the effect that it has since been cemented, in the 6¼" casing, up to a depth of 3265 feet and that the 6¼" casing has been perforated above the plug and cut off at about 3000 feet.

We have also been informed that after attempting to pump the well for a time, during which it produced about 100 barrels per day of water and 25 barrels per day of oil, all work was suspended and the well left in the above condition.

A report was made to the State Oil and Gas Supervisor on September 28, 1917, recommending certain work to remedy the condition of the well.

HONOLULU CONSOLIDATED OIL COMPANY

vs.

MIDWAY GAS COMPANY, Well No. 6, Sec. 16 T. 32 S., R. 24 E., M. D. B. & M.

March 9, 1917.

The Taft office of the State Mining Bureau received notice under the above date that complaint had been made against this well. The complaint cited the fact that the behavior of this well indicated a direct connection between the oil measures, being produced from, in it and in Well No. 11 of the Honolulu Consolidated Oil Company on Section 10, T. 32 S., R. 24 E., M. D. B. & M. It further stated that the well complained of was producing 20% emulsion, while the well liable to be damaged was producing clean oil, and added: "This means that if the upper measures are flooded by water from the Midway well, it is only a matter of time till water will appear in our well."

On March 26 the Midway Gas Company filed a proposal to test the well and determine the source of the water. The proposal was approved but work on the well has been delayed by mechanical troubles.

The department has recently been advised by the company that work is progressing more satisfactorily and that results may be expected in the near future.

PITTSBURG-BELRIDGE OIL COMPANY

vs.

THETA OIL COMPANY, or D. Y. CAMPBELL. Well in the S. ½ of the NE. ¼ of Sec. 25, T. 28 S., R. 20 E., M. D. B. & M.

April 7, 1917.

There is no development in the immediate vicinity of the well complained of and no investigation has as yet been made.

No log of this well has been furnished.

CHANSLOR-CANFIELD MIDWAY OIL COMPANY

vs.

STANDARD OIL COMPANY, Sec. 10, T. 32 S., R. 23 E., M. D. B. & M.

March 13, 1917.

A request was made for a continuation of the investigation previously started upon the informal request of both companies.

Graphic logs of the wells in question were drawn and an attempt was made to solve the problem. No satisfactory results were obtained and the matter is being held in abeyance until such time as peg models can be constructed of a considerable area in the vicinity.

BARLOW AND HILL

vs.

CRESCENT PETROLEUM CORPORATION, Sec. 2, T. 25 S., R. 19 E., M. D. B. & M.

July 30, 1917.

A letter under the above date requested that the department investigate the abandonment of the well mentioned and insure the proper plugging of the hole. The complainants were advised by letter on August 1, 1917, that all previous work on the well had received the sanction of this department, and that his proposed abandonment would no doubt be put before us in due time.

A proposal was later received and approved.

STATE MINING BUREAU

vs.

F. B. CHAPIN (Burks Oil Co., or Bay City Oil Co.), Sec. 22, T. 32 S., R. 23 E., M. D. B. & M.

August 15, 1917.

This investigation was initiated by the State Mining Bureau as a part of a general campaign to overcome the water troubles menacing this portion of the Midway oil field.

The company has furnished logs of several of its wells and is rigging up to furnish certain tests on those wells of which it claims to have no logs.

ASSOCIATED OIL COMPANY

vs.

KERN RIVER OIL COMPANY, Well No. 8, Sec. 4, T. 29 S., R. 28 E., M. D. B. & M.

March 3, 1916.

On February 27, 1917, a letter was received from the Associated Oil Company, referring to a former letter making informal complaint of the condition of the above mentioned well, and formally asking for an investigation.

Upon investigation it was learned that the Kern River Oil Company was contemplating the repair of the well. Very shortly thereafter the well was plugged in the bottom with clay. The results were very beneficial to the surrounding wells, but as yet no actual figures on production improvement have been obtained.

SAMUEL SANBORN

vs.

H. H. HENSHAW, well in Sec. 22, T. 25 S., R. 18 E., M. D. B. & M., Drilled by Devil's Den Consolidated Oil Co.

November 20, 1916.

The original complaint asked for an investigation of the abandonment, but merely referred to the well as an abandoned oil well on the southwest quarter of the section.

On November 20, 1916, the department requested a more definite location of the well in question and on November 22, 1916, this was received.

It was found that some work on these wells had previously been authorized by our Coalinga office. Mr. Sanborn was advised that the work, which had been approved, would adequately protect the territory. Lately, a proposal to do further work on the well in question has been received and is being replied to by this office.

INFORMAL COMPLAINTS AND REQUESTS FOR INVESTIGATION.

During the year informal complaints were made of the condition of the following wells of the Associated Oil Company in the Kern River field:

(Kern A) No. 12, Sec. 32, T. 28 S., R. 28 E., M. D. B. & M.

(Omar) No. 6 and No. 7, Sec. 32, T. 28 S., R. 28 E., M. D. B. & M.

(Kern) No. 9, Sec. 32, T. 28 S., R. 28 E., M. D. B. & M.

(Reed Crude A) No. 12, Sec. 32, T. 28 S., R. 28 E., M. D. B. & M.

(Reed Crude) No. 50, Sec. 32, T. 28 S., R. 28 E., M. D. B. & M.

(Canfield) No. 9, No. 14, No. 15, No. 27, No. 28, Sec. 29, T. 28 S., R. 27 E., M. D. B. & M.

(San Joaquin) No. 10 and No. 18, Sec. 5, T. 29 S., R. 28 E., M. D. B. & M.

The condition of these wells was brought to the attention of the company by a letter of the State Oil and Gas Supervisor, dated March 7, 1917. Under date of March 20, 1917, the company replied, stating in part as follows: "The informal complaints in the wells which you refer to will be thoroughly investigated."

Informal complaint was made on March 30, 1917, to the State Oil and Gas Supervisor by a Mr. McLennon of Bakersfield, of the manner in which the Bakersfield Junk Company was abandoning Well No. 2 of the Provident Oil and Mining Company on Section 25, Township 28 South, Range 27 East, M. D. B. & M. The work had been done under the close supervision of this department and up to that time was satisfactory. Work was later begun on Well No. 1 on the same property, but owing to the reluctance of the Junk Company to comply with the requirements of this department, it was finally given up before any pipe was removed from the well.

On January 22, 1917, the General Petroleum Corporation made informal complaint of the condition of two wells of the Mt. Diablo Oil, Mining and Development Company (Maylain property), Section 26, T. 32 S., R. 23 E., M. D. B. & M. On January 23, 1917, the company was asked to furnish logs of the wells. These have not yet been received. This matter will come in for thorough investigation in connection with the work just starting on the water troubles throughout sections 25 and 26, T. 32 S., R. 23 E., M. D. B. & M.

The informal complaint of the Consolidated Mutual Oil Company against the Record Oil Company, both in Section 28, T. 31 S., R. 23 E., M. D. B. & M., mentioned in Bulletin No. 73, page 124, has been held in abeyance pending the result of an investigation of the condition throughout Section 28. A more or less extensive investigation of this whole neighborhood was made and recommendations as to the repair of certain wells followed. Peg models were constructed and cross sections were made, but extreme difficulty in getting at the facts of the case was experienced, presumably on account of the fact that the title to Section 28 was being questioned by the Federal authorities. This whole section was in the hands of a receiver. As a result of the investigation the Kern Trading and Oil Company began building a rig over the crater of their Well No. 2, Section 27, T. 31 S., R. 23 E., M. D. B. & M., in the hope of being able to correct the water trouble resulting from the fire at this well while it was being drilled. The rig is now up and operations are expected to begin shortly.

About November 9, 1915, informal complaint was made by the Lakeview No. 2 Oil Company against the North American Oil Company Well No. 1, Section 4, T. 11 N., R. 23 W., S. B. B. & M., and the well of the Midway Fields Oil Company on the same section.

The former property is now being developed by Pat Welch and a well is being drilled within a few feet of the one complained of. It is not thought likely that the old well is doing any damage.

The property of the Midway Fields Oil Company is in the hands of the Receiver and no official logs of the wells have been furnished.

MISCELLANEOUS INVESTIGATIONS.

During the latter part of February, 1917, Mr. M. H. Murray made a hasty survey of the Kern River oil fields for the department, and reported on the production of oil and water from all producing wells. The information thus obtained was put on two maps, one for water and one for oil production, on each side of which a color scheme was used to denote the approximate amount each well produced.

On March 13, 1917, an investigation was started of water conditions along the west line of the southwest quarter of Section 32, T. 28 S., R. 28 E., M. D. B. & M., in the Kern River oil field. Release of the confidential information of the two interested companies was secured and a composite cross section was started. This work has not yet been completed, but when finished is to be placed at the disposal of both companies for their use in correcting the troubles along the line above referred to.

On August 15, 1917, work was started on a peg model of the N.W. ¼ of Section 31, T. 28 S., R. 28 E., M. D. B. & M., in the Kern River field. The object was to attempt to locate the source of a supposed intermediate water occurring in the vicinity. The model has since been completed but owing to the press of other work no use has as yet been made of it.

The matter of the water conditions in Section 22, T. 31 S., R. 23 E., M. D. B. & M., was the subject of a conference at the Taft office of the State Mining Bureau on September 6, 1916. At this conference representatives of the Standard and Associated oil companies met with the State Oil and Gas Supervisor. It was agreed that careful observations should be made for a time, the result of which would determine other tests to be made. The agreement was confirmed by a letter, dated September 20, 1916, from the Supervisor to each company.

Since that time the Standard Oil Company has abandoned one of the wells listed as a probable source of the water, but no improvement in the condition has been noted.

More recently the Associated Oil Company has requested a renewal of the investigation, but very little progress can be made in it until conditions in wells known to be in bad order on adjoining sections are corrected.

The manner of drilling the deep wells in the Belridge District has been brought to the attention of the Department, verbally, on numerous occasions. In an attempt to secure the adoption of a uniform method of drilling in that district, a number of operators met at the clubhouse of the Reward Oil Company at Reward, California, on December 4, 1916. The meeting was poorly attended, and while some good suggestions were offered nothing definite was accomplished.

The attention of this department was called to the fact that dye tests had previously been made by the Chanslor-Canfield-Midway Oil Co., and American Oilfields Company on wells in Section 36, T. 31 S., R. 22 E., M. D. B. & M. On January 22, 1917, these companies were asked to furnish reports of these tests. On January 31, 1917, the reports were received.

On February 13, 1917, the attention of the Department was called to the fact that the Dabney Oil Company, operating on Section 26, T. 31 S., R. 22 E., M. D. B. & M., had drilled its Well No. 8 into bottom

water and was preparing to case this water off with the upper producing oil measures of the district. The matter was taken up with the Dabney Oil Company, with the result that it was allowed to prospect deeper with the understanding that the condition would be corrected later. It was claimed by the company that no sand had been encountered at the depth where the producing oil measures had been expected.

LIST OF DECISIONS ISSUED IN KERN COUNTY OIL FIELDS.

T. 23 S., R. 17 E., M. D. B. & M.

SECTION 7.

Dominion Oil Co.

Well No. 1, abandon. DD-751.

Notice May 7, 1917, to pull casing and shut-off in accordance with the law. Reply May 9, 1917, specified plugs against the walls of the hole at four places and filling balance of hole with clay.

T. 23 S., R. 22 E., M. D. B. & M.

SECTION 12.

B. B. & E. R. Dudley Petroleum Co.

Well No. 1, commence drilling. DD-659.

Notice April 7, 1917, to shut-off at 1500′. Reply April 9, 1917, recommended that shut-off be made above the first showing of oil or gas, and showing tested.

T. 25 S., R. 19 E., M. D. B. & M.

SECTION 2.

Crescent Petroleum Co.

Well No. 1, redrill. DD-546.

Notice by letter, February 11, 1917. Reply February 13, 1917, that 8¼″ casing be cemented as proposed, to test showing.

Well No. 1, shut-off. D-740.

Notice March 27, 1917, describing tests and results and proposing to deepen. Test as described, accepted without visit and reported.

Well No. 1, deepen. DD-633.

Proposal to deepen approved.

Well No. 1, shut-off. D-896.

Notices of tests, April 27, 1917, and May 10, 1917, canceled by telephone. Final notice June 6, 1917. Tested and reported satisfactory shut-off June 15, 1917.

T. 26 S., R. 20 E., M. D. B. & M.

SECTION 3.

B. B. & E. R. Dudley Petroleum Co.

Well No. 2, deepen. DD-291.

Approved proposal contained: Notice October 14, 1916, to make lower shut-off.

Well No. 2, shut-off. D-566.

Bailed dry. Hole kept open by means of perforated liner. Test satisfactory.

Well No. 2, deepen. DD-723.

Approved proposal received April 30, 1917, to deepen 40′ to improve production.

Well No. 6, commence drilling. DD-661.

Recommended shut-off above oil from 205′ to 270′ as shown in No. 2, and tests by the department.

Associated Oil Co.

Well No. 2, commence drilling. DD-773.

Recommended that instead of making shut-off as proposed at 1300', it be made above upper oil zone.

Section 11.

B. B. & E. R. Dudley Petroleum Co.

Well No. 1, shut-off. D-385.

Test of 8¼" showed 100' of oil. No water. Recommended thorough test before deepening.

Well No. 1, deepen. DD-507.

Approved proposal to deepen through first oil sand.

Well No. 1, deepen. DD-695.

Approved proposal to deepen to other sands.

Associated Oil Co.

Well No. 1, begin drilling. DD-663.

Approved proposal as submitted.

Well No. 1, shut-off. D-909.

Test of shut-off above the proposed depth reported satisfactory.

Section 12.

Baker & Henshaw.

Well No. 1, deepen. AA-272.

Reported that damage might result from the proposed deepening.

Well No. 1, shut-off. A-198.

Reported test satisfactory without visit, on information furnished by operator in letter, dated September 3, 1916. Letter September 17, 1916, stated that warm salt water had broken into well at 6:30 a.m. September 15, 1916. Reply September 18, 1916, requested log.

Well No. 2, shut-off. AA-242.

Reply to letter describing work of mudding and cementing. Recommended pumping test. Replied November 28, 1916, on Form 113 to notice of deepening, requesting statement of present condition and result of mudding job. Letter received December 1, 1916, stated no mud had been put in this well.

Well No. 3, commence drilling. DD-380.

Approved proposal to drill. Recommended shut-off above and below sulphur water.

Well No. 3, shut-off. D-707.

Test of plugging off sulphur water inconclusive.

Recommended further test.

Well No. 3, shut-off. D-709.

Test inconclusive. Recommended pumping test.

Well No. 4, begin drilling. DD-667.

Recommended that top sands be tested and that any deepening be made the subject of a new proposal.

Section 13.

Associated Oil Co.

Well No. 6, deepen. AA-310.

Authorized deepening as proposed.

Well No. 10, redrill. DD-753.

Authorized proposal to plug for bottom water. Recommended plugging bottom sand in adjoining well before plugging higher in this one.

Well No. 14, redrill. DD-882.

Authorized proposal to perforate first string of pipe opposite shallow sands.

Associated Oil Co.

Well No. 25, redrill. DD-756.

Approved proposal to free oil string and plug lower portion of hole to shut off water.

Well No. 33, shut-off. A-155.

Repeated tests showed decreasing amounts of water. Recommended production test.

Well No. 34, begin drilling. AA-209.

Authorized proposal to experiment on an inside well in cementing off oil and water behind same string of pipe, and in this, a line well, provided proof could be given that oil sands so cased off were protected.

Well No. 34, plug bottom. DD-326.

Authorized proposal to plug hole from 1130′ to 775′ and test oil measures at 775′, and requested report on test of the 10″ shut-off.

Well No. 34, shut-off. D-547.

Reporting test by Special Deputy W. L. McLaine that 10″ shut-off had failed.

Well No. 34, redrill. DD-883.

Authorized proposal to perforate 10″ and test tar sands behind it.

Well No. 35, commence drilling. AA-317.

Authorized drilling the well as proposed.

Well No. 35, shut-off. D-377.

Reported test of shut-off satisfactory.

Well No. 35, redrill. DD-378.

Confirmed advice received from the company that well had been plugged for bottom water.

Well No. 36, shut-off. D-591.

12¾″ shut-off tested and found satisfactory.

Well No. 36, shut-off. D-625.

10″ shut-off not conclusive. Recommended that well be finished and water shut off in surrounding wells.

Well No. 36, redrill and plug. DD-569.

Authorized plugging bottom of hole but recommended bailing test before placing upper portion of plug. Letter of February 28, waived bailing test in favor of pumping test.

Well No. 36, shut-off. D-708.

Reported test of lower portion of plug satisfactory.

Well No. 37, begin drilling. DD-664.

Approved proposal as submitted.

Well No. 37, shut-off. D-824.

Pumping test indicated that the well had been satisfactorily finished.

General Petroleum Co.

Well No. 9-B, commence drilling. DD-857.

Authorized proposal to produce top oil without landing a water string, provided no water should be encouutered above the oil.

Well No. 10-B, commence drilling. DD-858.

Approved proposal to drill with one string of pipe if no top water was encountered.

Well No. 11-B, commence drilling. DD-859.

Approved proposal to finish with one string of pipe, but recommended a shut-off should top water be encountered.

Well No. 17-B, commence drilling. DD-860.

Approved proposal to finish with one string of pipe, but recommended a shut-off should top water be encountered.

Well No. 19-B, commence drilling. DD-861.

Approved proposal as submitted but recommended a shut-off before drilling into oil sand should upper water be encountered.

Lost Hills Development Co.

Well No. D-3, deepen. AA-304.

Approved proposal to deepen 100'. Requested report on tank gauges.

Well No. D-4, deepen. AA-305.

Approved proposal to deepen 100'. Requested report on tank gauges.

Well No. D-5, deepen. AA-306.

Approved proposal to deepen 100' and requested production reports.

Well No. C-4, commence drilling. DD-364.

Approved as proposed: "To drill with one string unless top water is found."

B. B. & E. R. Dudley Petroleum Co.

Well No. 1, redrill. DD-292.

Approved proposal to plug for bottom water.

Well No. 2, redrill. AA-238.

Recommended that well be plugged from bottom by stages to 530' if necessary.

Well No. 4, shut-off. A-206.

Report of test of shut-off my Special Deputy E. J. Schneider. Passed for production test.

Well No. 4, deepen. DD-290.

Approved proposal to make lower shut-off on account of encountering more water.

Well No. 4, shut-off. D-372.

Tested the deeper shut-off and found it satisfactory.

Well No. 4, deepen. DD-772

Authorized deepening 100'.

Well No. 5, shut-off. D-648.

Satisfactory test.

Well No. 8, shut-off. A-156.

Report of test witnessed by Mr. R. E. Stearns. Water shut-off.

Well No. 9, commence drilling. AA-220.

Approved as proposed.

Well No. 9, shut-off. A-171.

Report of shut-off witnessed by Special Deputy E. J. Schneider. Satisfactory.

Well No. 10, commence drilling. AA-286.

Approved drilling as proposed.

Well No. 10, shut-off. D-554.

Reported shut-off satisfactory based on operator's production report.

T. 26 S., R. 20 E., M. D. B. & M.

SECTION 24.

California Star Oil Co.

Well No. 1, bridge over the oil sand. AA-266.

Authorized plugging above oil sands and producing water from top water sands.

Well No. 1, redrill. DD-286.

Authorized proposal to commence plugging until sands previously thought of as top water sands were plugged off and attempt to produce sands above that point logged as tar sands.

Well No. 2, deepen. AA-265.

Authorized proposal to deepen to lower sands, and test them for production.

Well No. 2, redrill. DD-294.

Authorized proposal to test shallow sands cemented off behind the 10" casing.

Well No. 3, redrill. DD-295.

Authorized proposal to produce shallow sands previously cemented off behind the 10" casing.

Well No. 4, cement at about 380'. AA-271.

Approved proposal to drill well as outlined in letter dated August 10, 1916, amplifying original proposal.

California Star Oil Co.

Well No. 4, redrill. DD-287.

Authorized proposal to produce upper sands shut-off behind the 10" casing and previously regarded as tar sands.

Well No. 5, continue drilling. AA-302.

Approved changed plan to allow of testing tar sands which it was originally intended to cement off.

Well No. 5, shut-off. D-555.

Reported production test made by the company which showed that if any top water existed it was shut off from the shallow oil.

Well No. 7, commence drilling. AA-323.

Authorized proposal to produce upper sands.

Well No. 7, shut-off. D-556.

Reported production test made by the company showing negligible amount of water.

Well No. 8, commence drilling. DD-844.

Authorized proposal to produce top sands.

Well No. 9, continue drilling. AA-301.

Approved amplified proposal to drill and produce the upper sands.

Well No. 9, shut-off. D-557.

Reported production test made by company showing negligible amount of water.

Well No. 10, begin drilling. DD-563.

Approved proposal to drill as outlined.

Well No. 11, begin drilling. DD-596.

Approved proposal to drill as outlined.

Well No. 13, redrill. DD-296.

Authorized proposal to pull or perforate the 10" casing in order to produce sands cemented off behind it.

Well No. 14, cement at about 395'. AA-215.

Authorized proposal to drill as outlined.

Well No. 14, shut-off. A-168.

Report of test witnessed by Special Deputy W. L. McLaine. Passed for production test on account of heaving sand.

Well No. 14, redrill. DD-297.

Authorized proposal to pull or perforate the 10" casing and produce sands previously shut off behind same.

Well No. 14, shut-off. D-558.

Report of production test made by the company showing upper sands to be practically free of water.

Well No. 15, drill. DD-643.

Approved proposal to produce top sands.

Well No. 17, shut-off. A-161.

Reported pumping test made by the company before completing well which proved that upper productions were free of water.

Well No. 17, shut-off. A-183.

Production test witnessed which showed no water in the upper oil formations.

Well No. 17, redrill. DD-298.

Authorized proposal to pull or perforate 10" and produce upper oil sands.

Well No. 18, commence drilling. AA-241.

Authorized as proposed.

Well No. 18, test by pumping. AA-267.

Authorized change in proposal to complete well with one string and test by pumping.

Well No. 18, shut-off. A-184.

Production test witnessed showing that the well finished with one string of pipe produced only 8/10% of water.

Well No. 18, redrill. DD-299.

Authorized proposal to perforate the one string of pipe in the hole.

California Star Oil Co.

Well No. 21, shut-off. A-159.

Reported bailing test witnessed by Special Deputy W. L. McLaine. Passed for pumping test on account of heaving sands.

Well No. 21, redrill. DD-300.

Approved proposal to pull or perforate the 10" and produce top sands.

Well No. 21, shut-off. D-559.

Reported production test made by the company which showed 7% of water in the oil from the top sands.

Well No. 25, commence drilling. DD-539.

Authorized drilling as proposed.

Well No. 29, begin drilling. DD-771.

Authorized drilling as proposed. Company letter received June 11, 1917, asking for investigation of water showing in well. Reply June 11 stated that investigation had been started.

Well No. 30, commence drilling. DD-854.

Authorized proposal as outlined. Letter received June 20th stated water unexpectedly encountered. Reply June 27th, asked for logs.

Security Oil Co.

Well No. 1, commence drilling. DD-344.

Authorized drilling as outlined and recommended that if water is encountered it be shut off before entering oil sand.

Well No. 1, deepen. DD-517.

Authorized proposal to deepen to depth of an offsetting well.

Well No. 2, commence drilling. DD-345.

Authorized proposal to drill recommending that water be shut off if encountered.

Well No. 3, begin drilling. DD-654.

Authorized proposal to drill recommending that a shut-off be made if water is encountered.

Well No. 4, drill. DD-644.

Authorized proposal to drill recommending that shut-off be made before entering oil sand if water was found.

Well No. 15, begin drilling. DD-655.

Authorized proposal to drill; recommended that if water was found it be shut off before drilling in the oil sand.

Well No. 16, begin drilling. DD-759.

Authorized proposal to drill; recommended shutting off top water if encountered.

Well No. 26, begin drilling. DD-760.

Authorized drilling; recommended that top water be shut off if encountered.

T. 26 S., R. 21 E., M. D. B. & M.

SECTION 19.

General Petroleum Corporation.

Well No. 28, begin drilling. DD-821.

Approved proposal to drill; recommended a shut-off to exclude upper water if encountered.

Well No. 50, begin drilling. DD-820.

Approved proposal to drill; recommended a shut-off to exclude upper water if encountered.

Well No. 62, begin drilling. DD-822.

Approved proposal to drill; recommended a shut-off to exclude upper water if encountered.

Well No. 63, begin drilling. DD-823.

Approved proposal to drill with one string providing no top water is found.

Well No. 67, begin drilling. DD-824.

Approved proposal to drill with one string providing no top water is found.

General Petroleum Corporation.

Well No. 75, begin drilling. DD-825.

Approved proposal to drill. Recommended that top water be shut off if encountered.

Well No. 76, begin drilling. DD-826.

Approved proposal to drill. Recommended that top water be shut off if encountered.

Well No. 77, begin drilling. DD-827.

Approved proposal to drill. Recommended that top water be shut off if encountered.

Well No. 78, begin drilling. DD-812.

Approved proposal to drill. Recommended that top water be shut off if encountered.

Well No. 78-A, begin drilling. DD-828.

Approved proposal to drill. Recommended that top water be shut off if encountered.

Well No. 82, begin drilling. DD-829.

Approved proposal to drill. Recommended that top water be shut off if encountered.

Well No. 83, begin drilling. DD-830.

Approved proposal. Recommended that top water be shut off if encountered.

Well No. 84, begin drilling. DD-813.

Approved proposal but recommended that top water be shut off if encountered.

Well No. 89, begin drilling. DD-814.

Approved proposal specifying that top water be shut off if encountered.

Well No. 90, begin drilling. DD-831.

Approved proposal specifying that any top water be shut off before drilling in.

Well No. 100, begin drilling. DD-815.

Approved proposal specifying that any top water encountered be shut off.

Lost Hills Development Co.

Well No. G-1, commence drilling. DD-552.

(Now G. P. Co. Well No. 86.)

Approved as proposed.

Well No. G-2, commence drilling. DD-553.

(Now G. P. Co. Well No. 85.)

Approved as proposed.

Well No. H-1, commence drilling. AA-293.

(Now G. P. Co. Well No. 87.)

Approved as proposed.

Well No. H-2, commence drilling. DD-554.

(Now G. P. Co. Well No. 88.)

Approved as proposed.

Well No. I-1, commence drilling. AA-294.

(Now G. P. Co. Well No. 102.)

Approved as proposed.

Well No. I-2, commence drilling. DD-555.

(Now G. P. Co. Well No. 101.)

Approved as proposed.

Well No. J-1, commence drilling. AA-228.

(Now G. P. Co. Well No. 103.)

Approved as proposed.

Well No. K-1, commence drilling. AA-230

(Now G. P. Co. Well No. 118.)

Approved as proposed.

Well No. L-1, commence drilling. AA-231.

(Now G. P. Co. Well No. 119.)

Approved as proposed.

Lost Hills Development Co.
Well No. M-1, commence drilling. AA-227.
(New G. P. Co. Well No. 134.)
Approved as proposed.
Well No. N-1, commence drilling. AA-226.
(Now G. P. Co. Well No. 135.)
Approved as proposed.

General Petroleum Corporation.
Well No. 104, begin drilling. DD-816.
Approved proposal specifying that any top water encountered be shut off.
Well No. 105, begin drilling. DD-817.
Approved proposal specifying that any top water encountered be shut off.
Well No. 116, begin drilling. DD-832.
Approved proposal specifying that top water be shut off if encountered.
Well No. 117, begin drilling. DD-818.
Approved proposal specifying that top water be shut off if encountered.
Well No. 120, begin drilling. DD-819.
Approved proposal specifying that any top water encountered be shut off.
Well No. 121, begin drilling. DD-833.
Approved proposal specifying that any top water encountered be shut off.
Well No. 132, begin drilling. DD-834.
Approved proposal specifying that any top water encountered be shut off.
Well No. 133, begin drilling. DD-835.
Approved proposal specifying that any top water encountered be shut off.

Lost Hills Development Co.
Well No. B-5, commence drilling. AA-297.
(Now G. P. Co. Well No. 20.)
Approved top water shut-off at 450'.
Well No. B-9, commence drilling. AA-298.
(Now G. P. Co. Well No. 16.)
Approved top water shut-off at 450'.
Well No. C-8, commence drilling. DD-279.
(Now G. P. Co. Well No. 32.)
Approved top water shut-off at about 450'.
Well No. D-5, deepen. DD-506.
(Now Well G. P. No. 44.)
Authorized proposal to deepen 55'.
Well No. D-6, deepen. AA-229.
(Now G. P. Well No. 43.)
Approved proposal to deepen.
Well No. E-5, commence drilling. AA-299.
(Now G. P. Co. Well No. 53.)
Approved top water shut-off at 450'.
Well No. E-6, commence drilling. AA-300.
(Now G. P. Co. Well No. 54.)
Approved top water shut off at 450'.
Well No. F-3, drill in, DD-367.
(Now G. P. Co. Well No. 74.)
Authorized drilling the well in without cementing.
Well No. F-5, commence drilling. DD-278.
(Now G. P. Co. Well No. 72.)
Approved top water shut off at 450'.

SECTION 29.

Associated Oil Co.
Well No. 1-C, redrill and plug. DD-515.
Authorized pulling pipe back and plugging.

Associated Oil Co.
Well No. 1-E, redrill. DD-336.
Authorized deepening specifying that sands between shoes of the 8¼" and 10" casing be thoroughly mudded.
Well No. 1-E, deepen and cement. DD-342.
Approved proposal to use cement instead of mud to seal sands between shoes of 8¼" and 10" casings.
Well No. 1-E, shut-off. D-563.
Satisfactory test of shut-off by 8¼" casing.
Well No. 2-B, begin drilling. DD-570.
Approved proposal as outlined.
Well No. 2-B, shut-off. D-714.
Approved test of shut-off as satisfactory.
Well No. 2-C, drill. DD-612.
Authorized proposal as outlined.
Well No. 2-C, shut-off. D-800.
Approved as satisfactory.
Well No. 3-C, commence drilling. DD-856.
Authorized proposal to shut off at 650'.

SECTION 30.

Universal Oil Co.
Well No. 5, abandon. AA-214.
Specified that bottom water be plugged before abandoning the well and placing upper plugs.
Well No. 12, deepen. AA-256.
Authorized prospecting. Recommended temporary shut-off below a probable edge—water sand..
Well No. 12, shut-off. A-196.
Report of test of shut-off witnessed by Special Deputy C. J. Schneider. Indeterminate.
Devils Den Consolidated Oil Co.
Well No. 9, redrill. DD-680.
Authorized proposal to plug for bottom water.

SECTION 32.

Universal Oil Co.
Well No. 13, redrill. AA-279.
Authorized proposal to shut off water and test first oil sand.
Well No. 32, redrill. DD-624.
Approved proposal to replace oil string and carry same through the oil sand.

T. 26 S., R. 26 E., M. D. B. & M.

SECTION 11.

Hale Syndicate.
Well No. 1, drill. DD-475.
Authorized drilling point of shut-off to be determined by results of drilling.

T. 27 S., R. 19 E., M. D. B. & M.

SECTION 8.

Standard Oil Co.
Well No. 1, shut-off. D-366.
Test of shut-off satisfactory.
Standard Mercantile Co.
Well No. 1, shut-off. D-770.
Shut-off approved as satisfactory.

T. 27 S., R. 20 E., M. D. B. & M.

SECTION 20.

Petroleum Midway Co., Ltd.

Well No. 1, commence drilling. AA-325.

Authorized proposal as outlined and requested notice of any change of plans.

SECTION 26.

Belridge Oil Co.

Well No. 12, commence drilling. DD-282.

Authorized proposal as outlined.

Well No. 14, shut-off. D-760.

Approved test as satisfactory, mentioned fact that large size and light weight of pipe rendered bailing deeper inadvisable. Recommended cementing the next string with sufficient cement to reach the shoe of this one in order to prevent water level inside this pipe getting so low as to endanger a collapse.

SECTION 27.

Belridge Oil Co.

Well No. 7, shut-off. A-170.

Reported on information furnished by the company that well flowed oil after bailing. Passed for production test.

Well No. 11, commence drilling. DD-281.

Authorized proposal as outlined.

Well No. 7, shut-off. A-181.

Production test after well had flowed three days showed no water in oil.

Well No. 8, commence drilling. AA-252.

Approved proposal, specifying that water be shut off 50′ higher than proposed.

Well No. 10, commence drilling. AA-255.

Approved proposal as outlined.

Well No. 10, shut-off. D-365.

Reported witnessing satisfactory test.

Well No. 10, shut-off. D-612.

Reported witnessing satisfactory test.

Well No. 10, deepen. DD-597.

Authorized proposal to deepen to increase production.

SECTION 34.

Reward Oil Co.

Well No. 2, cement 10″ at 2800′. AA-261.

Rejected proposal to deepen until the department had been furnished results of attempts to produce from above the depth of 2800′.

Well No. 2, shut-off. A-169.

Report of test of 12½″ casing, from information furnished by the company, shut-off approved.

Well No. 2, shut-off. D-661.

Reported witnessing satisfactory test of shut-off, and that cementing had stopped flow of oil outside the string cemented.

Well No. 3, shut-off. D-527.

Reported satisfactory test of 12½″ casing which had been cemented with 40 sacks at the shoe and had had six tons pumped out through collapsed casing at 1854′.

Well No. 3, shut-off. D-654.

Reported satisfactory test of shut-off by 10″ casing.

Well No. 3, shut-off. D-741.

Reported witnessing test showing rise in water level. Recommended further test.

Well No. 3, shut-off. D-743.

Reported witnessing test showing uniform rise in water level. Advised screwing up pipe and further test.

Reward Oil Co.

Well No. 3, shut-off. D-746.

Reported witnessing test showing rise of one foot per hour probably due to casing leak. Passed with the recommendation that if leak became worse a further shut-off be made.

Standard Oil Co.

Well No. 1 (Barneson), commence drilling. AA-224.

Approved as proposed.

Well No. 1, shut-off. D-621.

Reported that shut-off in the 10" casing prevents water from above 2040' penetrating oil sands below that depth, but that failure of 12½" shut-off not previously reported endangers the oil horizon at about 2400' which is productive in neighboring wells.

Well No. 1 (Barneson), shut-off. D-884.

Reported test of shut-off by 8¼" casing at 4015', showed slight rise in water level thought to be due to oil coming in.

SECTION 35.

Belridge Oil Co.

Well No. 1, redrill. DD-385.

Requested log-casing record and proposed method of protecting upper oil zone.

Well No. 1, redrill. DD-535.

Recommended that hole be mudded under pressure as proposed before cementing.

Well No. 1, redrilling. DD-670.

Approved amended proposal to fill with mud behind the 6¼" casing instead of the 8¼" casing as proposed (on account of 8¼" casing having gone back at shoe joint) and to pull 8¼" and 10" casing.

Well No. 1, shut-off. D-803.

Reported satisfactory test of shut-off.

Well No. 2, shut-off. A-162.

Reported satisfactory test of shut-off.

Well No. 2, shut-off. A-162.

Reported satisfactory test based on information furnished by the company. Passed for production test.

Well M. M. No. 2, redrill. DD-534.

Authorized proposal to test cementing of 4¾" casing and clean out to original bottom.

Well No. 4, shut-off. A-153.

Reported satisfactory test based on information furnished by the company. Passed for production test.

Well No. 4, redrill. DD-351.

Authorized proposal to cement 4¾" string in attempt to shut off water.

Well No. 4, abandon. DD-571.

Authorized proposal to abandon hole, specifying certain plugging and tests thereon.

Well No. 4, shut-off. D-756.

Approved plugging at 3140'.

Well No. 9, commence drilling. AA-253.

Recommended shut-off at 2300' instead of 3300' as proposed and tests of all formation below shut-off.

Well No. 9, shut-off. D-626.

Reported witnessing satisfactory test of shut-off at 1730'.

Well No. 9, shut-off. D-811.

Reported witnessing satisfactory test of shut-off at 2330'. Hole showing oil.

SECTION 36.

Union Oil Company.

Well No. 2 (Gibson), commence drilling. DD-868.

Approved proposal to shut off at 400' and test shallow sands.

Union Oil Co.

Well No. 1, shut-off. A-152.

Reported test of formations between 693' to 3100' based on information furnished by company. Recommended bailing test.

Well No. 1, deepen. DD-288.

Approved proposal to cement 8¼" casing at 3850' with enough cement to seal formations up to 2580', providing it will be shown that the work prevents water entering formations above 3200'.

Well No. 1, shut-off. D-553.

Reported water shut-off at shoe of 8¼" casing at 3850', but that sealing of formations to 3580' failed as shown by the fact that water and oil were flowing outside the 8¼" casing.

Well No. 1 (Belridge), shut-off. D-610.

Reported water shut-off at shoe of 6¼" at 4006', but that water and gas were flowing between the 6¼" and the 8¼" and that a gas stratum was being flooded.

Well No. 1, deepen. DD-528.

Approved proposal to free 6¼" casing and cement deeper. Recommended mudding off gas stratum.

Well No. 1 (Gibson), commence drilling. DD-501.

Approved top water shut-off at 750'. Recommended second shut-off above second water and third shut-off below it.

Well No. 1 (Gibson), shut-off. D-598.

Reported witnessing satisfactory test at 655' and good showing of heavy oil at that depth.

Well No. 1 (Gibson), redrill and plug. DD-533.

Approved proposal to plug off water at 1057' and test sands above.

Standard Oil Co.

Well No. 1 (Gibson), abandon. DD-621.

Approved proposal to continue plugging from 4230' and abandon.

T. 27 S., R. 21 E., M. D. B. & M.

SECTION 4.

General Petroleum Corporation.

Well No. 8, redrill and cement. DD-514.

Approved proposal as outlined—to make lower shut-off.

Well No. 8-A, shut-off. D-688.

Reported witnessing test that showed shut-off unsuccessful.

Well No. 8-A, shut-off. D-776.

Reported witnessing a test that showed small amount of water coming into hole. Passed for production test.

Well No. 10-A, shut-off. A-200.

Reported test based on information furnished by the company. Shut-off satisfactory.

Well No. 42-A, commence drilling. AA-263.

Approved point of shut-off providing that it be made at the same depth stratigraphically as surrounding wells.

Well No. 42-A, deepen and re-cement. DD-310.

Authorized proposal to cement off the upper oil sand (thought to carry water) and produce lower.

Well No. 43-A, shut-off. A-187.

Reported witnessing production test showing oil practically free of water.

Well No. 48-A, commence drilling. AA-264.

Approved as satisfactory the proposed depth of shut-off.

Well No. 49-A, shut-off. A-201.

Reported test based on information furnished by the company. Shut-off approved.

General Petroleum Corporation.
Well No. 50, shut-off. A-202.
Reported test based on information furnished by the company. Shut-off approved.
Well No. 51-A, shut-off. A-188.
Reported witnessing production test showing 1/10 per cent water.
Well No. 53-A, commence drilling. AA-318.
Proposal approved as outlined.
Well No. 53-A, shut-off. D-512.
Reported witnessing satisfactory test of shut-off at the depth proposed.
Well No. 54-A, shut-off. A-203.
Report of test of shut-off made by the company approved.
Well No. 55-A, shut-off. A-204.
Report of test of shut-off made by the company approved.

Standard Oil Company.
Well No. 54, shut-off at 1920'. AA-216.
Approved proposal specifying that enough cement be used to seal all formation up to a depth of 1750' to protect offsetting wells with a higher shut-off.
Well No. 54, shut-off. A-191.
Reported satisfactory test of shut-off based on information furnished by the company.

SECTION 5.

B. B. & E. R. Dudley Petroleum Co.
Well No. 1, redrill. AA-237.
Authorizing verbal proposal to put in 6¼" perforated liner instead of redrilling as proposed.

General Petroleum Co.
Well No. 3-B, shut-off. A-190.
Reported witnessing production test showing well to produce only small amount of water.
Well No. 4-B, shut-off. A-189.
Reported satisfactory test of shut-off based on information furnished by the company.
Well No. 8-B, commence drilling. AA-315.
Approved proposal as outlined, but noted that notice of test of shut-off was received before notice of intention to drill.
Well No. 8-B, shut-off. A-209.
Reported satisfactory test of shut-off based on information furnished by the company.

Universal Oil Co.
Well No. 1, deepen. DD-335.
Approved proposal to cement off upper sand and drill into second sand.
Well No. 1, shut-off. D-545.
Reported witnessing satisfactory test of landing of pipe used to case off upper oil sand.

Standard Oil Co.
Well No. 10, shut-off. D-578.
Reported that production reports submitted by the company indicated that top water was shut off.

SECTION 9.

D. J. Oil Co.
Well No. 2, shut-off. D-544.
Reported witnessing test of shut-off and requesting further bailing which as reported by the company indicated satisfactory shut-off.
Well No. 3, commence drilling. AA-284.
Approved proposal as outlined.

D. J. Oil Co.
Well No. 3, shut-off. D-649.
Reported witnessing satisfactory test of shut-off.

Standard Oil Co.
Well No. 50, shut-off. D-579.
Reported satisfactory top water shut-off based on monthly production reports of the company.

SECTION 17.

Associated Oil Co.
Well No. 1, plug bottom. DD-547.
Approved proposal as outlined to pull 6¼" and 8¼" casings and fill hole with cement from 5324' to 3177'.
Well No. 1, abandon. DD-625.
Approved proposal to cut and pull 8¼" casing from about 1800'. Withheld decision on balance of proposal.
Well No. 1, abandon. DD-632.
Recommended attempting to force cement through collapsed pipe to fill bottom of hole or redrilling below bad place and shooting and plugging.
Well No. 1, abandon. DD-642.
Recommended shooting at the collapsed place and plugging shot cavity. Waived redrilling required in former report on account of receipt of reports from company of tests on the lower portion of the hole.

T. 28 S., R. 21 E., M. D. B. & M.

SECTION 30.

Pittsburg-Belridge Oil Co.
Well No. 4, shut-off. D-592.
Reported witnessing satisfactory test of top water shut-off.
Well No. 5, begin drilling. DD-572.
Approved proposal as outlined.
Well No. 5, shut-off. D-737.
Reported satisfactory test of shut-off.
Well No. 6, begin drilling. DD-665.
Approved proposal as outlined.
Well No. 6, shut-off. D-865.
Reported witnessing satisfactory test of top water shut-off.

SECTION 32.

Belridge Oil Co.
Well No. 391, abandon. DD-709.
Recommended plugging between 768' and 780' or filling with rotary mud before dismantling rig as proposed.
Well No. 393, abandon. DD-710.
Recommended plugging between 670' and 730' or filling with rotary mud before dismantling rig.
Well No. 395, abandon. DD-711.
Recommended plugging between 675' and 732' or filling with rotary mud before dismantling rig.

SECTION 33.

Belridge Oil Co.
Well No. 112, shut-off. A-148.
Reported witnessing production test showing large percentage of water. Recommended further tests.
Well No. 112, shut-off. A-192.
Reported witnessing production test showing large percentage of water. Requested regular production gauges.

Belridge Oil Co.

Well No. 135, abandon. DD-283.

Approved proposal to move rig and drill new well.

Well No. 209, commence drilling. AA-254.

Authorized proposal to drill to second zone providing the water is excluded from upper zone.

Well No. 209, shut-off. D-560.

Reported witnessing satisfactory test of top water shut-off.

Well No. 209, shut-off. D-586.

Reported witnessing satisfactory test of the oil protection string.

Well No. 210, commence drilling. DD-284.

Approved proposal as outlined.

Well No. 210, shut-off. D-507.

Reported witnessing satisfactory test of top water shut-off.

Well No. 408, shut-off. A-154.

Reported satisfactory test of landing of 10" casing based on information furnished by the company. Referred to letter concerning non-protection of upper sands.

Well No. 408, deepen. DD-558.

Approved proposal to deepen as outlined.

Well No. 411, begin drilling. DD-653.

Approved proposal to drill as outlined.

Well No. 411, shut-off. D-775.

Reported witnessing satisfactory test of top water shut-off.

T. 28 S., R. 27 E., M. D. B. & M.

Section 5.

Standard Oil Co.

Well No. 1, shut-off. D-275.

Reported shut-off indeterminate without visit. Authorized prospecting ahead.

Well No. 1, abandon. DD-419.

Authorized abandonment, recommending additional work.

Section 15.

Well No. 2, abandon. DD-467.

Approved work outlined but specified additional plugging between 2490′ and 2530′.

May 29th received report of abandonment which showed plugging specified from 2490′ to 2530′ had not been done.

Replied May 31st stating that on account of failure to place the plug, approval of the abandonment could not be given.

June 15th received amended log from Standard Oil Co., which omitted statement on former log that the sand logged from 2530′ to 2535′ "acted like water sand."

June 25th, referred matter of discrepancies in logs to State Oil and Gas Supervisor.

June 28th, State Oil and Gas Supervisor requested explanation of San Francisco office of Standard Oil Company.

June 28th, received letter from Standard Oil Co. stating that field superintendent thought the driller was mistaken in logging the sand as a water sand. Letter also requested an approval of the abandonment, inferring that the plug was not necessary.

August 9th, 1917, received copy of letter from field superintendent to W. O. Todd, both of the Standard Oil Co., stating that on April 29th the field superintendent had placed a burnt wire line bridge at 2530′ and a cement plug thereon at 2490′.

September 4th, State Oil and Gas Supervisor wrote the San Francisco office of Standard Oil Company stating:

"Careful consideration of the above-mentioned records leave us the choice of three propositions:

First—Either the plug was not inserted because it was not necessary; or

Second—The plug was put in and not reported, notwithstanding the fact that such a piece of work would require enough time to certainly be noted in any complete report of operations.

Third—Supplemental reports, contradicting previous records or conclusions have been filed without being substantiated.

This department can not assume to choose between such a wide variation of statements in making any report as to the condition of the well."

No further copy in Bakersfield files.

Well No. 1, abandon. DD-466.

Approved work and specified additional plugging.

April 11th, waived additional plugging on receipt of information from the company that certain sands had been tested and found barren.

May 14th, replied to report of May 4th, describing work done in abandoning, stating that work as outlined would satisfactorily protect oil formations.

SECTION 25.

Provident Oil & Mining Co.

Well No. 1, abandon. DD-443.

February 26th, recommended cleaning to bottom and plugging for possible bottom water.

May 4th, received affidavit from J. A. Korst stating no bottom water encountered in drilling well.

May 10th, letter to State Oil and Gas Supervisor reporting conversation with Mr. Korst, in which he retraced the statements in his affidavit as to the time he worked on the well and as to whether or not bottom water was encountered in the well.

Well No. 2, abandon. DD-444.

February 26th, approved and recommended additional work.

March 30th, Mr. McLennan of Bakersfield informed San Francisco office of the Bureau that the well was being abandoned.

March 30th, telegram from State Oil and Gas Supervisor asking investigation.

March 30th, reply to State Oil and Gas Supervisor stated that inspector had visited the well each working day since work began to note progress.

SECTION 27.

Standard Oil Co.

Well No. 2, shut-off. D-423.

Reported witnessing test showing shut-off effective at shoe, but withholding approval on account of failure to secure approval of the deepening and casing off of oil sands behind $8\frac{1}{4}$" pipe.

Well No. 2, redrill. DD-450.

Approved proposal to plug bottom of hole and test oil sands cased off behind $8\frac{1}{4}$" pipe.

Well No. 2, abandon. DD-472.

Approved proposal to abandon on account of collapsed pipe. Recommended minor changes in location of plugs.

May 31st, approved abandonment as described in subsequent report.

Well No. 3, redrill. DD-432.

Approved proposal to move rig 75' and drill. No oil penetrated at first location. Depth 2026'.

Well No. 3, shut-off. D-437.

Reported witnessing bailing test of shut-off. Test indeterminate account of oil in pipe. Passed for a production test.

SECTION 35.

Standard Oil Co.
Well No. 2, "State," abandon. DD-460.
Approved proposal specifying certain additional plugging.
March 31st, letter authorizing shooting and plugging at the point specified.
May 14th, approved abandonment as outlined in report of company dated May 4th.
Well No. 3, "State," redrill. DD-468.
Approved proposal to cut out string of casing, above specified depth.

SECTION 36.

Kern River Drillers Oil Co.
Well No. 3, redrill. DD-433.
Approved proposal to make new shut-off with 8¼" casing 14' deeper.

T. 28 S., R. 28 E., M. D. B. & M.

SECTION 19.

Traffic Oil Co.
Well No. 20-A, redrill. DD-260.
Approved proposal to redrill oil string.
Well No. 38, drill. DD-474
Approving proposal as outlined.

Traders Oil Co.
Well No. 52, redrill. DD-218.
Approved proposal to redrill oil string providing water is properly shut off.

Requested logs.
Well No. 64, drill. DD-407.
Approving proposed point of shut-off.

Traffic Oil Co.
Well No. 38, shut-off. D-438.
Sand heaving, passed for production test.

SECTION 20.

Boston Petroleum Co.
Well No. 12, shut-off. D-353.
Reported witnessing satisfactory test.
Well No. 12, redrill. DD-409.
Approved proposal to plug bottom with cement to shut off bottom water.
Well No. 12, shut-off. D-432.
Reported witnessing production test showing bottom water satisfactorily plugged off.
Well No. 16, drill. DD-493.
Approved proposal as outlined.
Well No. 17, drill. DD-494.
Approved proposal as outlined.

Yellowstone Oil Co.
Well No. 6, redrill. DD-461.
Approved proposal to redrill oil string.
Well No. 9, drill. DD-462.
Approved proposal to redrill as outlined.
Well No. 9, shut-off. D-431.
Reported witnessing satisfactory test of shut-off.
Well No. 10, drill. DD-483.
Approved proposal as outlined.
Well No. 10, shut-off. D-435.
Reported witnessing satisfactory test.

SECTION 28.

Bankers Oil Co.
Well No. 36, drill. DD-401.
Authorized drilling with one string of pipe if no top water was encountered.
Well No. 37, drill. DD-410.
Authorized drilling with one string of pipe if no top water was encountered.

SECTION 29.

Virginia Oil Co.
Well No. 5, deepen. DD-498.
Authorized deepening from 900′ to 980′.
Well No. 12, deepen. DD-476.
Approved deepening from 940′ to 980′ on condition that bottom water would be shut off if encountered.
Well No. 16, redrill. DD-477.
Proposal as outlined approved.
Well No. 21, deepen. DD-454.
Proposal approved as outlined.
Well No. 22, deepen. DD-455.
Proposal approved as outlined.
Well No. 23, deepen. DD-456.
Proposal approved as outlined.
Well No. 24, deepen. DD-457.
Proposal approved as outlined.

SECTION 30.

Associated Oil Co.
Well No. 9-A, G. & W., shut-off. D-392.
Witnessed and approved.
Well No. 10-A, G. & W., shut-off. D-393.
Witnessed and approved.
Well No. 11-A, G. & W., shut-off. D-358.
Witnessed and approved.
Well No. 11-A, G. & W., redrill. DD-423.
Approving proposal to plug for bottom water.
Well No. 12-A, G. & W., shut-off. D-283.
Witnessed and approved.
Well No. 14-A, G. & W., shut-off. D-282.
Witnessed and approved.
Well No. 15-A, G. & W., shut-off. D-294.
Witnessed and approved.
Well No. 16-A, G. & W., shut-off. D-326.
Witnessed and approved.
Well No. 17-A, G. & W., shut-off. D-332.
Witnessed and approved.
Well No. 18-A, G. & W., shut-off. D-391.
Witnessed and approved.
Well No. 19-A, G. & W., shut-off. D-369.
Witnessed but rejected. Water in hole.
Well No. 19-A, G. & W., shut-off. D-397.
Witnessed and approved.
Well No. 20-A, G. & W., shut-off. D-284.
Witnessed and approved.
Well No. 21-A, G. & W., shut-off. D-311.
Witnessed and approved.
Well No. 22-A, G. & W., shut-off. D-312.
Witnessed and approved.

Associated Oil Co.
Well No. 25-A, G. & W., shut-off. D-331.
Witnessed and approved.
Well No. 26-A, G. & W., shut-off. D-346.
Witnessed and approved.
Well No. 27-A, H. & W., shut-off. D-350.
Witnessed and approved.
Well No. 5, Luck, drill. DD-398.
Well No. 5, Luck, shut-off. D-413.
Well No. 9, Luck, shut-off. D-402.
Well No. 10, Luck, shut-off. D-400.
Well No. 11, Luck, shut-off. D-403.
Well No. 11, Luck, redrill. DD-411.
Well No. 12, Luck, shut-off. D-404.
Well No. 12, Luck, redrill. DD-417.
Well No. 16, Luck, shut-off. D-396.
Well No. 16, Luck, redrill. DD-424.
Well No. 17, Luck, redrill. DD-469.
Well No. 17, Luck, drill. DD-496.
Well No. 18, Luck, shut-off. D-399.
Well No. 18, Luck, redrill. DD-442.
Well No. 19, Luck, shut-off. D-411.
Well No. 20, Luck, shut-off. D-418.
Well No. 20, Luck, shut-off. D-419.
Well No. 24, Luck, shut-off. D-394.
Well No. 24, Luck, redrill. DD-418.
Well No. 25, Luck, shut-off. D-408.
Well No. 26, Luck, shut-off. D-405.
Well No. 27, Luck, shut-off. D-406.
Well No. 28, Luck, shut-off. D-414.
Traffic Oil Co.
Well No. 4, drill.
Withheld approval pending receipt of logs.
Well No. 4, shut-off. D-420.
Withheld approval on account of failure to furnish logs
Well No. 4, drill. DD-439.
Issued on receipt of logs. Approved proposal.
Well No. 4, shut-off. D-422.
Issued on receipt of logs. Approved proposal.
Well No. 5, begin drilling. DD-499.
Well No. 8, Euclid, shut-off. D-337.
Well No. 9, shut-off. D-313.
Frank May.
Well No. 6, shut-off. D-401.
Bald Eagle Oil Co.
Well No. 13-A, shut-off. D-267.

SECTION 31.

Associated Oil Co.
Well No. 4, Sycamore, redrill. DD-215.
Well No. 10, Sycamore, redrill. DD-427.
Well No. 11, Sycamore, redrill. DD-395.
Well No. 12, Sycamore, redrill. DD-428.
Well No. 13, Sycamore, shut-off. D-268.
Well No. 14, Sycamore, shut-off. D-269.
Well No. 15, Sycamore, shut-off. D-257.
Well No. 16, Sycamore, shut-off. D-258.
Well No. 17, Sycamore, shut-off. D-250.
Well No. 18, Sycamore, shut-off. D-270.

Associated Oil Co.
Well No. 34, Sterling, redrill and deepen. DD-214.
Well No. 5, Queen Esther, shut-off. D-409.
Well No. 26-A, G. & W., shut-off. D-346.
Well No. 4, H. & F., redrill. DD-459.
Well No. 5, Hanford-Fresno, shut-off. D-301.
Well No. 6, Hanford-Fresno, shut-off. D-307.

Peerless Oil Co.
Well No. 3, locate and shut off water. DD-266.
Well No. 5, redrill. DD-451.
Well No. 14, redrill. DD-464.
Well No. 14, abandon. DD-465.
Well No. 26, shut-off. D-362.
Well No. 28, redrill. DD-397.
Well No. 33, redrill. DD-479.
Well No. 41, redrill. DD-471.
Well No. 41, redrill. DD-490.
Well No. 42, shut-off. D-181.
Well No. 42, redrill to shut-off water. DD-412.
Well No. 43, shut-off. D-182.
Well No. 43, redrill. DD-222.
Well No. 49, shut-off. D-342.
Well No. 51, redrill. DD-446.
Well No. 53, shut-off. D-183.
Well No. 54, redrill. DD-233.
Well No. 54, abandon. DD-405.
Well No. 67, shut-off. D-184.
Well No. 70, shut-off. D-256.
Well No. 71, drill. DD-408.
Well No. 71, shut-off. D-417.
Well No. 72, drill. DD-484.

Sovereign Oil Co.
Well No. 9, redrill. DD-232.
Well No. 11, drill. DD-478.

Vesta Oil Co.
Well No. 12, redrill. DD-254.
Well No. 12, redrill and deepen. DD-473.
Well No. 14, redrill. DD-482.

Calloma Oil Co.
Well No. 7, shut-off. D-314.

SECTION 32.

Associated Oil Co.
Well No. 4, Omar, redrill. DD-253.

SECTION 33.

Kern River Oilfields Co. Ltd.
Well No. 10, redrill. DD-228.
Well No. 10, shut-off. D-276.
Well No. 11-B, abandon. DD-430.

T. 29 S., R. 28 E., M. D. B. & M.

SECTION 2.

Petroleum Development Co.
Well No. 16, drill. DD-491.

SECTION 3.

J. E. Gray Estate.
Well No. 25, shut-off. D-244.
Witnessed. Approved.
Well No. 26, shut-off. D-306.
Well No. 27, drill. DD-440.
Well No. 27, shut-off. D-425.
Well No. 28, drill. DD-458.
Well No. 28, shut-off. D-428.
Well No. 29, drill. DD-486.
Well No. 29, shut-off. D-436.

SECTION 4.

Clampitt Oil Co.
Well No. 17, drill. DD-402.
Well No. 17, shut-off. D-416.
Well No. 18, drill. DD-403.
Well No. 18, shut-off. D-424.
Well No. 19, drill. DD-404.

Kern Four Oil Co.
Well No. 2, B. J., redrill. DD-390.
Well No. 6, B. J., redrill and deepen. DD-394.

East Puente Oil Co.
Well No. 1, redrill. DD-488.
Well No. 1, abandon. DD-497.

Kern River Oil Co.
Well No. 8, redrill. DD-480.
Well No. 9, B. J., redrill. DD-431.
Well No. 12, B. J., redrill. DD-413.

Petroleum Development Co.
Well No. 28, redrill. DD-445.
See complaint No. 17.
Well No. 28, shut-off. D-427.
See complaint No. 17.

Alma Oil Co.
Well No. 2., Jr., redrill. DD-447.
See complaint No. 17.

Apollo Oil Co.
Well No. 1, redrill. DD-434.

SECTION 5.

Standard Oil Co.
Well No. 8 (M. C. No. 1), redrill. DD-492.
Well No. 10 (M. C. No. 1), redrill. DD-429.
Well No. 13 (M. C. No. 1), abandon. DD-414.
Well No. 16 (M. C. No. 1), abandon. DD-393.
Well No. 24 (M. C. No. 1), redrill. DD-435.
Well No. 24 (M. C. No. 1), shut-off. D-430.
Well No. 28 (M. C. No. 1), redrill. DD-485.
Well No. 29 (M. C. No. 1), redrill. DD-437.
Well No. 30 (M. C. No. 1), abandon. DD-421.
Well No. 38 (M. C. No. 1), redrill. DD-436.
Well No. 42 (M. C. No. 1), redrill. DD-438.
Well No. 42 (M. C. No. 1), shut-off. D-426.
Well No. 51 (M. C. No. 1), redrill and abandon DD-415.
Well No. 51 (M. C. No. 1), shut-off. D-433.
Well No. 68 (M. C. No. 1), drill. DD-463.
Well No. 68 (M. C. No. 1), shut-off. D-429.

Associated Oil Co.
Well No. 5, S. J., redrill. DD-226.
Well No. 5, S. J., shut-off. D-407.
Well No. 5, S. J., redrill. DD-470.
Well No. 5, S. J., shut-off. D-434.
Well No. 40, S. J., shut-off. D-295.
Well No. 41, S. J., shut-off. D-271.
Well No. 42, S. J., shut-off. D-248.

Amaurot Oil Co.
Well No. 2, abandon. DD-422.
Well No. 2, redrill. DD-425.
Well No. 4, redrill. DD-453.

Del Rey Oil Co.
Well No. 1, West, redrill. DD-416.
Well No. 6, redrill and deepen. DD-487.
Well No. 9, redrill. DD-269.
Well No. 9, shut-off. D-410.
Well No. 10, East, redrill and deepen. DD-396.

SECTION 6.

Calex Oil Co.
Well Nos. 1 and 2, redrill and deepen. Notice 9/25/16.

Enos Oil Co.
Well No. 14, shut-off. D-249.
Well No. 15. Redrill. DD-285.
Well No. 15, shut-off. D-395.
Well No. 18, redrill. DD-392.

SECTION 8.

Prairie Oil Co.
Well No. 3, shut-off. D-246.
Well No. 3, redrill. DD-495.

Harris and Stevens Corp.
Well No. 1, Volcan, redrill. DD-448.
Well No. 6, Ohio Crude, redrill. DD-449.

Frank May Oil Co.
Well No. 1, Golden Rod, redrill. DD-441.
Well No. 6, drill. DD-391.

Montgomery and Cole.
Well No. 4, shut-off. D-340.

Tar & McComb, Inc.
Well No. 5, Volcan, redrill. DD-481.

SECTION 9.

Petroleum Development Co.
Well No. 4, shut-off. D-341.
Well No. 5, shut-off. D-251.
Well No. 6, shut-off. D-398.
Well No. 7, drill. DD-420.
Well No. 7, shut-off. D-421.
Well No. 8, shut-off. D-299.
Well No. 9, drill. DD-406.
Well No. 9, shut-off. D-415.
Well No. 11, drill. DD-400.
Well No. 11, shut-off. D-412.

Junction Oil Co.
Well No. 5, old well, abandon. DD-262.
Well No. 6, redrill. DD-399.
Well No. 7, redrill. DD-224.
Well No. 7, abandon. DD-236.
Well No. 7, shut-off. D-390.
Well No. 9, abandon. DD-221.
Well No. 9, shut-off. D-317.

May Oil Co.
Well No. 9, redrill. DD-426.

Capital City Oil Co.
Well No. 3, redrill. DD-452.

T. 29 S., R. 20 E., M. D. B. & M.

SECTION 36.

Shear Petroleum Co.
Well No. 12, shut-off. D-265.
Reported satisfactory test of shut-off based on information furnished by the company.

T. 29 S., R. 21 E., M. D. B. & M.

SECTION 2.

General Petroleum Co.
Well No. 32-A, shut-off. A-175.
Reported witnessing production test showing very little water in the oil.
Well No. 54-A, shut-off. D-585.
Reported satisfactory test of shut-off based on information furnished by the company.
Well No. 55, shut-off. D-354.
Reported satisfactory test of shut-off based on information furnished by the company.
Well No. 97, drill. DD-619.
Approved proposal as outlined.
Well No. 97, shut-off. D-850.
Reported witnessing satisfactory test of shut-off.
Well No. 98, drill. DD-693.
Approved proposal as outlined.
Well No. 99, drill. DD-719.
Approved proposal as outlined.
Well No. 122, drill. DD-718.
Approved proposal as outlined.
Well No. 123, drill. DD-717.
Approved proposal as outlined.
Well No. 123, shut-off. D-915.
Reported witnessing satisfactory test of shut-off.
Well No. 86 (new No. 124), drill. DD-618.
Approved proposal as outlined.
Well No. 124, shut-off. D-857.
Reported witnessing satisfactory test of shut-off.
Well No. 125, drill. DD-716.
Approved proposal as outlined.
Well No. 126, drill. DD-715.
Approved proposal as outlined.
Well No. 127, drill. DD-721.
Approved proposal as outlined.

SECTION 3.

General Petroleum Corporation.

Well No. 14-A, shut-off. A-205.

Reported satisfactory test of shut-off, based on information furnished by the company.

Well No. 15, shut-off. D-361.

Reported satisfactory test of shut-off based on information furnished by the Company.

Well No. 15, abandon. DD-370.

Authorized proposed abandonment but specified below 12½" instead of in same.

Well No. 18-A, shut-off. D-536.

Reported witnessing satisfactory test of shut-off.

Well No. 20-A, shut-off. D-371.

Reported witnessing satisfactory test of shut-off.

Well No. 21, drill. DD-315.

Approved proposal as outlined.

Well No. 21, shut-off. D-777.

Reported witnessing satisfactory test of shut-off.

Well No. 25, drill. DD-620.

Approved proposal as outlined.

Well No. 30, drill. DD-316.

Approved proposal as outlined.

Well No. 30, shut-off. D-820.

Reported satisfactory test of shut-off based on information furnished by the company.

Well No. 45-A, shut-off. A-174.

Reported witnessing production test showing practically no water.

Marina Oil Co.

Well No. 1, shut-off. D-596.

Reported witnessing satisfactory test of top water shut-off.

Well No. 2, shut-off. D-615.

Reported witnessing satisfactory test of shut-off.

Well No. 3, shut-off. D-629.

Reported satisfactory test of shut-off based on observation of inspector and letter from company.

Well No. 3, shut-off. D-883.

Reported witnessing satisfactory test of shut-off.

Well No. 4, drill. DD-508.

Authorized proposal as outlined.

Well No. 4, shut-off. D-687.

Reported satisfactory test of shut-off based on letter from the company.

Well No. 4, redrill. DD-701.

Approved proposal as outlined.

Well No. 5, drill. DD-617.

Approved proposal as outlined.

Well No. 6, drill. DD-713.

Authorized as proposed.

Well No. 9, drill. DD-509.

Approved as proposed.

Well No. 9, shut-off. D-637.

Reported witnessing satisfactory test of shut-off.

Well No. 10, drill. DD-510.

Authorized as proposed.

Well No. 10, shut-off. D-660.

Reported witnessing test of shut-off and passing same for production test on account of heaving sand.

Well No. 11, drill. DD-556.

Authorized as proposed.

Marina Oil Co.
Well No. 11, shut-off. D-749.
Reported witnessing satisfactory test of shut-off.
Well No. 12, shut-off. DD-576.
Authorized as proposed.
Well No. 12, shut-off. D-836.
Reported witnessing satisfactory test of shut-off.
Well No. 13, drill. DD-703.
Approved proposal as outlined.
Well No. 17, drill. DD-511.
Approved proposal as outlined.
Well No. 17, shut-off. D-698.
Reported satisfactory test of shut-off based on observations of inspector and letter from company.
Well No. 18, drill. DD-557.
Approved proposal as outlined.
Well No. 18, shut-off. D-715.
Reported failure of shut-off based on letter from the company and authorized cementing second string deeper.
Well No. 18. Shut-off. D-757.
Reported witnessing satisfactory test of shut-off.
Well No. 19, drill. DD-577.
Approved proposal as outlined.
Well No. 19, shut-off. D-802.
Reported witnessing test of shut-off and passing for a production test.
Well No. 20, drill. DD-705.
Approved proposal as outlined.
Well No. 20, shut-off. D-835.
Reported witnessing satisfactory test of shut-off.
Well No. 21, drill. DD-578.
Approved proposal as outlined.
Well No. 21, shut-off. D-797.
Reported witnessing test of shut-off and passing well for production test.
Well No. 22, drill. DD-579.
Approved proposal as outlined.
Well No. 22, shut-off. D-822.
Reported witnessing satisfactory test.
Well No. 23, drill. DD-706.
Approved as proposed.
Well No. 28, drill. DD-615.
Approved as outlined.
Well No. 28, shut-off. D-801.
Reported witnessing satisfactory test of shut-off.
Well No. 29, drill, DD-614.
Approved proposal as outlined.
Well No. 29, shut-off. D-758.
Reported witnessing satisfactory test of shut-off.
Well No. 30, drill. DD-707.
Approved proposal as outlined.
Well No. 35, drill. DD-616.
Approved proposal as outlined.
Well No. 36, drill. DD-708.
Approved proposal as outlined.
Well No. 42, drill. DD-712.
Approved proposal as outlined.
Well No. 43, drill. DD-775.
Approved as proposed.
Well No. 49, drill. DD-776.
Approved as proposed.

Marina Oil Co.
Well No. 50, drill. DD-777.
Approved as proposed.
Well No. 51, drill. DD-778.
Approved as proposed.
Well No. 55, drill. DD-845.
Approved proposal as outlined.

SECTION 8.

Standard Oil Co.
Well No. 1, M. & L., No. 2, drill. DD-542.
Approved proposal and required a test of shut-off before drilling through any oil encountered above the proposed depth of shut-off.

SECTION 11.

General Petroleum Co.
Well No. 3-B (now No. 14-B), redrill. DD-532.
Approved proposal as outlined.
Well No. 3-B (now No. 14-B), shut-off. D-712.
Reported witnessing test of shut-off of old string of 10" showing water not shut off. Asked for further proposal.
Well No. 9-B (now No. 7-B), shut-off. D-387.
Reported witnessing test showing small amount of sulphur water probably from formations below the shut-off. Shut-off reported satisfactory.
Well No. 9-B (now No. 7-B), shut-off. D-650.
Reported witnessing test of second shut-off showing small amount of water. Recommended prospecting ahead.
Well No. 11-B, drill. DD-694.
Approved proposal as outlined.
Well No. 11-B, shut-off. D-812.
Reported witnessing satisfactory test of shut-off.

SECTION 25.

Sunbeam Oil Co.
Well No. 1, drill. DD-353.
Approved proposal as outlined.

SECTION 26.

United Western Oil Co.
Well, Arcadia No. 1, test old well. DD-234.
Approved proposal to clean out and pump.

United Western Consolidated Oil Co.
Well No. 2, drill. DD-645.
Approved proposal as outlined.
Well No. 2, shut-off. D-804.
Reported witnessing test of shut-off showing rise in water line of two feet per hour. Recommended further test.
Well No. 2, shut-off. D-808.
Reported witnessing test of shut-off. Passed for production test on account of sand in pipe.

Suncrest Oil Co.
Well No. 1, shut-off. D-685.
Reported witnessing test showing 10" casing had failed to shut off water.
Well No. 1, shut-off. D-796.
Reported witnessing test of shut-off showing that 8¼" casing had probably not shut off water. Recommended further test.

Sunerest Oil Co.

Well No. 1, shut-off. D-889.

Reported witnessing test of shut-off after recementing the 8¼" casing, showing only slight rise in water level, but recommended further tests on account of the fact that sand in the pipe prevented a conclusive test.

NOTE.—This well was put to producing and the company reported it producing clear and ready for test. Before the date set for test it was reported that water had broken in. Since that time the well is reported to have produced water intermittently. The source of the water has not yet been determined.

H. S. Williams Oil Co.

Well No. 9, shut-off. D-277.

Reported witnessing test of shut-off. Sand heaving prevented conclusive test.

Well No. 9, cement off lower sand. DD-247.

Approved proposal to plug back with cement to shut off sulphur water found below the 10" casing.

Well No. 9, redrill. DD-545.

Approved proposal to make lower shut-off at 1245' and advised making same at 1350'.

Well No. 9, shut-off. D-696.

Reported witnessing test of lower shut-off showing same unsatisfactory.

Well No. 9, shut-off. D-753.

Reported witnessing test of shut-off after recementing. Test inconclusive on account of having sand.

Well No. 9, deepen. DD-700.

Approved proposal to redrill and make deeper shut-off.

Well No. 17, shut-off. D-300.

Reported witnessing satisfactory test of shut-off by 10" casing.

Well No. 17, shut-off. D-338.

Reported witnessing satisfactory test of shut-off by 8¼" casing.

Well No. 17, deepen. DD-581.

Approved proposal to deepen and replace perforated with screen pipe.

Well No. 19, drill. DD-314.

Approved proposal as outlined.

Well No. 19, shut-off. D-605.

Reported witnessing test. Passed for production test on account of heaving sand.

Well No. 20, abandon. DD-347.

Approved proposal to plug off bottom water and abandon. Required tests of plugging.

Well No. 50, drill. DD-613.

Approved proposal as outlined.

Well No. 50, shut-off. D-881.

Reported witnessing satisfactory test of shut-off.

Well No. 51, shut-off. D-359.

Reported witnessing test of shut-off. Passed for production test on account of heaving sand.

Well No. 53, shut-off. D-832.

Reported witnessing test of shut-off. Passed for production test on account of heaving sand.

SECTION 27.

Standard Oil Co.

Well No. 2, M. P., shut-off. D-633.

Reported witnessing test of shut-off. Test inconclusive on account of crew having run bailer before arrival of inspector.

SECTION 36.

West Penn Co. Incorporated.

Well No. 1, abandon. DD-235.

Approved proposal and specified extra plugging.

West Penn Co. Incorporated.
Well No. 1, drill. DD-306.
Approved proposal to drill new No. 1.
Well No. 2 (now No. 1), shut-off. D-587.
Reported witnessing test showing constant amount of sulphur water coming in.
Well No. 2 (now No. 1), shut-off. D-763.
Reported witnessing satisfactory test of shut-off.
Well No. 3 (now No. 2), drill. DD-519.
Approved proposal as outlined.

Standard Oil Co.
Well No. 1, McPhee, shut-off. D-280.
Reported satisfactory test of shut-off based on verbal information from company.
Well No. 1, shut-off. D-363.
Reported witnessing satisfactory test. Letter October 14th requesting company to furnish report of formations penetrated between the two points of shut-off.
Well No. 1, McPhee, redrill. DD-595.
Rejected proposal to redrill pending receipt of log and history.
Well No. 1, McPhee, redrill. DD-598.
Approved proposal to redrill as above and stated that approval should have been given in DD-595 as information requested had at that time been furnished.
Well No. 2, drill. DD-371.
Approved proposal as outlined.
Well No. 2, McPhee, shut-off. D-771.
Reported witnessing satisfactory test.
Well No. 3, McPhee, drill. DD-543.
Approved proposal as outlined.

T. 29 S., R. 22 E., M. D. B. & M.

SECTION 18.

Union Oil Co.
Well No. 1, Coyote, abandon. DD-264.
Approved proposal to abandon as outlined.

SECTION 32.

Barnsdale, Drake & Yancey.
Well No. 1, abandon. DD-731.
The proposal stated that there was no record of the well other than the total depth and the amount of various sizes of pipe charged to the well. The report specified plugging at certain depths based on the assumption that the well was identical with a well known as Globe Exploration Co. No. 1, of which a log was found in the file.
Well No. 1, shut-off. D-840.
Reported witnessing a test to determine advisability of modifying previous requirements, which substantiated belief that plugging should be done as specified.
Well No. 1, shut-off. D-929.
Reported witnessing test which showed that cement at top of plug (at 1666') was set hard.
At the time of this test the crew was preparing to shoot the 6⅝" casing. This work was held up by the inspector, who explained to the driller that it was particularly desired to leave conductor pipe to the top of the lower plug.
The inspector then took the driller to McKittrick to enable him to communicate with his employers, the Midway Supply Company.
It was later learned that the driller returned and fired the shot in spite of the warning. After some negotiations the Midway Supply Company cleaned out through the shot cavity and left it standing full of mud to prevent filling in with sand and to permit of access to the lower portion of the hole should future development demonstrate the necessity of additional plugging.

T. 29 S., R. 37 E., M. D. B. & M.

SECTION 27.

William. Bosustow Co.

Well No. 1, abandon. DD-658.

Approved proposal as outlined. Letter received May 7, 1917, furnished report of the work and asked permission to cement into water well.

Reply May 9th stated the department had no objection to plan to make use of the water developed.

T. 30 S., R. 21 E., M. D. B. & M.

SECTION 11.

Jackson Oil Co.

Well No. 6, shut-off. D-279.

Reported satisfactory test of top and bottom water shut-off, based on report from superintendent.

Well No. 7, shut-off. D-264.

Reported satisfactory test based on report by superintendent.

Well No. 8, drill. DD-513.

Approved as proposed.

Well No. 8, shut-off. D-700.

Reported witnessing satisfactory test.

East Puente Oil Co.

Well No. 2 (Lease 2), redrill. DD-369.

Approved proposal to bridge in oil string below water string and perforate above bridge and force cement out into formation below water string in an effort to shut off top water.

Well No. 2 (Lease 2), redrill. DD-376.

Approved amended proposal to put cement in through 1¼" pipe between the strings instead of through perforations. The work decreased the water from 8% to ½ of 1%.

Well No. 4 (Lease 2), shut-off. D-600.

Reported witnessing satisfactory test.

Well No. 5 (Lease 2), drill. DD-368.

Approved proposal as outlined.

Well No. 5, shut-off. D-772.

Reported witnessing satisfactory test.

Well No. 6, drill. DD-897.

Approved as proposed.

Well No. 7, drill. DD-913.

Approved as proposed.

Josephine Oil Co.

Well No. 1, abandon. DD-649.

Approved as proposed. Could not get water shut off. Did not penetrate oil. To be cemented to water well.

Well No. 2, drill. DD-646.

Approved as proposed.

Well No. 2, shut-off. D-844.

Reported witnessing test. Recommended further tests.

Well No. 2, shut-off. D-849.

Reported witnessing test showing failure of shut-off attempted with mud fluid behind 10" casing at 844'.

Well No. 2, shut-off. D-910.

Reported witnessing satisfactory test of shut-off; 10" casing cemented at 965'

Kern Trading & Oil Co.
Well No. 3, shut-off. D-510.
Reported witnessing satisfactory test.
Well No. 3, Foltz, shut-off. D-880.
Reported witnessing indeterminate test of plugging to exclude bottom water. Passed for production test on account of heaving sand.
Well No. 4, drill. DD-866.
Approved proposal as outlined.

SECTION 12.

Associated Oil Co.
Well No. 1, California Standard, abandon. DD-275.
Recommended cementing where 10" cut and plugging up to bottom of 12½" casing.

SECTION 13.

Berry and Keller Co.
Well No. 3, new, drill. Letter, 8/1/16.
Approved proposal specifying that shut-off be made uniform with those of adjoining wells.
Well No. 3, shut-off. D-290.
Reported satisfactory test of shut-off based on information submitted by the company.
Well No. 8, redrill. DD-541.
Recommended testing water string by using dye or by bridging under it and redrilling as proposed.
Well No. 8, shut-off. D-713.
Reported witnessing test showing water string to be tight.
Well No. 13, shut-off. D-242.
Reported test showing no leak in water string.
Well No. 15, redrill. DD-763.
Approved proposal to replace perforated with screen pipe.
Well No. 16, shut-off. D-370.
Reported witnessing satisfactory test.
Well No. 17, shut-off. D-542.
Reported witnessing satisfactory test.
Well No. 18, drill. DD-504.
Approved proposal as outlined.
Well No. 18, shut-off. D-614.
Reported witnessing satisfactory test.

Reward Oil Co.
Well No. 5, deepen and redrill. DD-243.
Approved proposal to deepen for submergence for air lift.
Well No. 33, redrill. DD-240.
Approved proposal to redrill oil string.
Well No. 42, drill. Letter 8/10/16.
Approved proposal specifying that shut-off be made uniform with those of adjoining wells.
Well No. 42, shut-off. D-384.
Reported witnessing satisfactory test. It was reported that after cementing the 10" casing at 850' with 40 sacks the 12½" casing was freed and used to tamp in a bridge around the 10" casing from 267' to 248'. On this 39 sacks of cement were placed as the 12½" was pulled, the idea being to keep water from a gas sand from 615' to 755' which it was desired to produce.

Associated Oil Co.
Well No. 15, Del Monte, redrill. DD-365.
Approved proposal to replace oil string and use screen pipe.
Well No. 32, Del Monte, redrill. DD-366.
Approved proposal to pull oil string and replace with screen pipe.

Kern Trading & Oil Co.
Well No. 26, redrill. DD-600.
Approved proposal as outlined.

Jewett Oil Co.
Well No. 15, drill. Letter, 12/20/16.
Approved proposal and requested logs.
Well No. 15, shut-off. D-716.
Reported witnessing test. Passed for production test on account of heaving sand.
Well No. 15, redrill. DD-871.
Approved proposal to plug off bottom sands and perforate water string.

SECTION 14.

San Francisco & McKittrick Oil Co.
Well No. 3, abandon. DD-355.
Approved proposal as outlined.
Well No. 3-A, drill. DD-540.
Approved proposal as outlined.
Well No. 3-A, shut-off. D-653.
Reported witnessing satisfactory test.
Well No. 4, old, abandon. DD-322.
Approved proposal specifying that plug be placed in the formation below the water string as well as in the shoe of same.
Well No. 4, new (now 4-A), drill. DD-323.
Approved as proposed.
Well No. 4½ (now 4-A), shut-off. D-540.
Reported witnessing satisfactory test.
Well No. 9, deepen. DD-230.
Approved as proposed.
Well No. 12, deepen. DD-669.
Approved as proposed.
Well No. 15, deepen. DD-880.
Approved as proposed.
Well No. 16, deepen. DD-790.
Approved as proposed.

T. 30 S., R. 22 E., M. D. B. & M.

SECTION 6.

Standard Oil Co.
Well No. 1, Sea B, shut-off. D-646.
Reported witnessing satisfactory test.
Well No. 1, Sea B, redrill. DD-594.
Approved proposal to redrill and cement water string deeper.
Well No. 1, Sea B, shut-off. D-815.
Reported witnessing test showing some water coming in. Recommended further bailing.
Well No. 1, Sea B, shut-off. D-856.
Reported witnessing satisfactory test.
Well No. 2, Sea B, shut-off. D-647.
Reported witnessing satisfactory test.
Well No. 3, McKittrick, drill. DD-307.
Approved proposal.
Well No. 3, shut-off. D-573.
Reported witnessing satisfactory test.
Well No. 3, McKittrick, shut-off. D-622.
Reported witnessing satisfactory test.
Well No. 3, shut-off. D-761.
Reported witnessing satisfactory test. Withheld decision as to point of landing.

Standard Oil Co.
Well No. 4, McKittrick, shut-off. D-511.
Reported witnessing satisfactory test.
Well No. 4, McKittrick, redrill. DD-630.
Approved proposal to plug bottom and if necessary to cement new water string. Since the close of the year the well was abandoned for lack of production.
Well No. 5, McKittrick, drill. DD-562.
Approved as proposed.
Well No. 5, shut-off. D-833.
Reported witnessing satisfactory test.
Well No. 6, McKittrick, shut-off. D-652.
Reported witnessing satisfactory test.

Nevada County Oil Co.
Well No. 3 (now No. 43), redrill. DD-319.
Approved as proposed.
Well No. 43, redrill. DD-878.
Approved proposal to plug bottom of hole and test upper sands.
Well No. 44, abandon. DD-879.
Approved abandonment. Specified certain plugging.
Well No. 45, redrill. DD-320.
Approved proposal with recommendations.
Well No. 47, drill. DD-354.
Approved as proposed.
Well No. 47, shut-off. D-697.
Reported witnessing satisfactory test.
Well No. 48, shut-off. D-787.
Reported witnessing test. Passed for production test on account of heaving formation.

Pittsburg Oil & Gas Co.
Well No. 1, shut-off. D-351.
Reported satisfactory test.
Well No. 1, shut-off. D-551.
Reported witnessing satisfactory test.
Well No. 1, deepen and cement. DD-363.
Approved proposal to cement deeper.

Nacirema Oil Co.
Well No. 1, redrill. DD-520.
Approved proposal to redrill oil string and determine casing record. No log had been preserved.
Well No. 2, drill. DD-529.
Approved as proposed.

SECTION 8.

Standard Oil Co.
Well No. 2, shut-off. D-327.
Reported satisfactory test.
Well No. 2, McKittrick, shut-off. D-597.
Reported witnessing and approving test showing only small amount of water coming in.
Well No. 2, shut-off. D-839.
Reported witnessing test showing no water coming into hole. Gave notice that the redrilling and resulting depth of cementing were not authorized.

SECTION 10.

Midway Supply Co.
Well No. 1, Barnsdale, Yancy & Drake, abandon. DD-729.
Approved proposal specifying that hole be filled from bottom to top with clay or surface formation.
Description of the work received May 4th from Midway Supply Co. indicates specifications were not followed.

SECTION 16.

Standard Oil Co.

Well No. 1, Spreckels, drill. DD-536.

Approved proposal. Required notification of tests of sands below 450'.

Well No. 1, Spreckels, shut-off. D-762.

Reported witnessing satisfactory test of 12½" casing cemented at 1090'. The department was not called to witness test of 15¼" at 440' as required in DD-536.

Well No. 1, Spreckels, shut-off. D-882.

Reported witnessing satisfactory test. No approval had been given for the work tested.

Well No. 2, Spreckels, drill. DD-537.

Approved.

Well No. 2, Spreckels, shut-off. D-916.

Reported witnessing satisfactory test, but gave no clearance on account of shut-off having been made lower than proposed.

SECTION 19.

Associated Oil Co.

Well No. 4, W. D., abandon. DD-377.

Approved. Requested log.

SECTION 29.

Midway Royal Petroleum Co.

Well No. 3, drill. DD-691.

Approved.

SECTION 34.

Doheny Pacific Petroleum Co.

Well No. 1, Abandon. DD-804.

On May 25th a written proposal to abandon the well was received. It stated: "The proposed work is as follows: To withdraw 5⅝" casing set by our company and leave well in condition received, as per our contract with original holders." It was understood that the work referred to had been done the previous month.

The above report recommended "that this department be called upon to witness a bailing test to determine: 1. Whether or not there is water in the hole. 2. The gravity of the oil."

The company then furnished an original statement of the driller descriptive of the tests previously made, to which this department replied in part as follows: "The well is not in proper condition for this department to issue an approval on the work of abandonment that has been done. I trust that your Company and the parties from whom your Company leased the land will, in the near future, get together and lay before this department a proposal for abandoning the well properly."

A conference of the parties interested was held at the Taft office of the State Mining Bureau on August 28th, 1917, which resulted in a new proposal dated September 10th, 1917. This proposal was rejected in report No. P-4-680 dated September 13th, 1917, as the work proposed neglected to properly protect the lower portion of the hole. This report required cleaning the hole out to 1400' and shooting to destroy sidetracked pipe, and certain plugging and tests above that depth. It was later modified and after the hole was cleaned out to 1320' it was shot and plugged at that depth and then bailed for a test by the department. At this test the well showed a large amount of heavy oil and very little water.

It is thought likely that the well can be made into a profitable producer in its present condition.

Combined Oil Co.

Well No. 3, shut-off. D-703.

Witnessed satisfactory test.

Well No. 3, redrill. DD-801.

Approved.

T. 31 S., R. 22 E., M. D. B. & M.

SECTION 2.

J. E. O'Donnell Lease.
Well No. 1, abandon. DD-225.
Approved.

Doheny Pacific Petroleum Co.
Well No. 1, J. E. O'Donnell, redrill. DD-263.
Approved.
Well No. 1, shut-off. D-335.
Witnessed satisfactory test.

Associated Oil Co.
Well No. 1, drill. Letter, 5/18/17.
Well No. 1, shut-off. D-602.
Witnessed satisfactory test.
Well No. 2, drill. Letter, 5/18/17.
Well No. 2, shut-off. D-754.
Witnessed satisfactory test.

SECTION 3.

Doheny Pacific Petroleum Co.
Well No. 2, shut-off. D-320.
Witnessed satisfactory test.
Well No. 2, abandon. DD-608.
Approved.
Well No. 3, abandon. DD-568.
Approved.

J. E. O'Donnell Lease.
Well No. 3, drill. Letter, 7/28/16.
Approved.

SECTION 11.

Doheny Pacific Petroleum Co.
Well No. 1, shut-off. D-729.
Witnessed satisfactory test.
Well No. 2, shut-off. D-595.
Witnessed satisfactory test.

SECTION 12.

Correspondence re Wells of Midland Oilfields, Ltd.
See Complaint No. 21.

SECTION 14.

Manley and McGinn.
Well No. 6, shut-off. D-752.
Witnessed satisfactory test.
Well No. 7-C, drill. DD-699.
Approved.
Well No. 7-C, shut-off. D-827.
Witnessed satisfactory test.
Well No. 8, Cherokee, drill. DD-764.
Approved.
Well No. 8, shut-off. D-859.
Witnessed inconclusive test.
Well No. 8, shut-off. D-860.
Witnessed satisfactory test.
Well No. 9-C, Drill. DD-890.
Approved.

Alberta Midway Oil Co.
Well No. 7, shut-off. D-588.
Witnessed satisfactory test.
Well No. 8, shut-off. D-523.
Witnessed satisfactory test.
Well No. 9, shut-off. D-348.
Witnessed satisfactory test.
Well No. 11, shut-off. D-571.
Witnessed satisfactory test.
Well No. 12, shut-off. D-513.
Witnessed satisfactory test.
Well No. 13, shut-off. D-324.
Witnessed satisfactory test.

Engineers Oil Co.
Well No. 6, drill. Letter, 9/30/16.
Approved.
Well No. 6, shut-off. D-683.
Witnessed satisfactory production test.
Well No. 7, shut-off. D-879.
Witnessed satisfactory test.
Well No. 8, drill. DD-896.
Approved.

General Petroleum Corporation.
Well No. 4, Alberta Midway, deepen. DD-875.
Approved.
Well No. 11, redrill. DD-874.
Approved. Recommended tests.

W. & S. Oil Co.
No. 3 or C, abandon. DD-906.
Rejected on account of failure to furnish logs. Further proposals were received on July 11th and July 20th, which were rejected for lack of logs on July 25th.
On Aug. 14th, after receipt of the logs, specifications for the abandonment of the well were written.
On Sept. 14th, in answer to a supplementary notice, these specifications were modified.

Combined Oil Co.
Well No. 1, redrill to 1500'. DD-257.
Approved.
Well No. 7, redrill. DD-317.
Approved.

SECTION 15.

Midway Peerless Oil Co.
Well No. 10, shut-off. D-288.
Witnessed satisfactory test.
Well No. 10, shut-off. D-319.
Witnessed satisfactory test.
Well No. 11, shut-off. D-328.
Witnessed satisfactory test.
Well No. 12, shut-off. D-376.
Witnessed satisfactory test.
Well No. 13, drill. DD-688.
Approved.
Well No. 13, shut-off. D-781.
Witnessed satisfactory test.
Well No. 14, drill. DD-900.
Approved.

Midway Peerless Oil Co.
Well No. 14, shut-off. D-846.
Witnessed satisfactory test.
Well No. 15, drill. DD-901.
Approved.

General Petroleum Corporation.
Well No. 7, redrill and deepen. DD-886.
Approved.
Well No. 15, redrill. DD-876.
Approved.
Well No. 19, redrill. DD-885.
Approved.
Well No. 35, redrill. DD-877.
Approved.

Hondo Oil Co.
Well No. 11, shut-off. D-247.
Reported satisfactory test, not witnessed.
Well No. 12, shut-off. D-532.
Witnessed satisfactory test.
Well No. 13, shut-off. D-682.
Witnessed satisfactory test.
Well No. 14, shut-off. D-645.
Witnessed satisfactory test.
Well No. 15, shut-off. D-719.
Witnessed satisfactory test.

Potter Oil Co.
Well No. 1-A, shut-off. D-730.
Witnessed satisfactory test.
Well No. 28, drill. DD-865.
Approved.
Well No. 28, shut-off. D-920.
Witnessed satisfactory test.

SECTION 21.

State Consolidated Oil Co.
Well No. 5, redrill. DD-609.
Approved.

SECTION 23.

Rock Oil Co.
Well No. 2, fluid level. D-906.
Measured fluid level on account of Complaint No. 6.
Well No. 4, fluid level. D-863.
Measured fluid level on account of Complaint No. 6.

General Petroleum Corporation.
Well No. 3, abandon. DD-567.
Approved.

Kern Trading and Oil Co.
Well No. 5, redrill. DD-853.
Approved proposal to plug off oil sands at bottom and perforate water string to produce tar sands, cased off behind same in drilling.
Well No. 13, redrill. DD-849.
Approved proposal to plug off oil sands and perforate water string to produce so-called tar sands.
Well No. 14, shut-off. D-516.
Witnessed satisfactory test.

Tumbador Oil Co.
Well No. 12, drill. Letter, 7/5/16.
Well No. 12, shut-off. D-325.
Witnessed satisfactory test.
Well No. 13, shut-off. D-352.
Witnessed satisfactory test.

SECTION 24.

Brookshire Oil Co.
Well No. 7, fluid level. D-918.
Determined on account of Complaint No. 12.

San Francisco Midway Oil Co.
Well No. 2, redrill. DD-607.
Approved proposal to do work on account of Complaint No. 6.

SECTION 25.

Visalia Midway Oil Co.
Well No. 6, shut-off. D-634.
Witnessed satisfactory test.
Well No. 6, redrill. DD-628.
Approved.
Well No. 6, shut-off. D-793.
Passed for production test.
Well No. 7, shut-off. D-694.
Witnessed satisfactory test.

Kern Trading and Oil Co.
Well No. 1, abandon. DD-805.
Approved.

SECTION 26.

C. C. M. O. Co.
Well No. 16, shut-off. D-821.
Witnessed inconclusive test.
Well No. 16, shut-off. D-826.
Witnessed satisfactory test.
Well No. 17, drill. DD-735.
Approved.
Well No. 19, drill. DD-736.
Approved with recommendations.
Well No. 20, drill. DD-737.
Approved with recommendations.
Well No. 22, drill. DD-738.
Approved with recommendations.

A. and J. Oil Co.
Well No. 4, redrill. DD-792.
Approved.

Reward Oil Co.
Well No. 3, shut-off. D-670.
Witnessed satisfactory test.
Well No. 3, shut-off. D-786.
Witnessed inconclusive test.

Pyramid Oil Co.
Well No. 5, plug bottom. DD-640.
Approved.
Well No. 9, redrill. DD-512.
Approved.
Well No. 15, shut-off. D-524.
Witnessed satisfactory test.
Well No. 15, redrill. DD-641.
Approved.

California Star Oil Co.
Well No. 2, redrill. DD-724.
Approved.
Well No. 4, redrill. DD-309.
Approved.
Well No. 4, redrill. DD-806.
Approved.
Well No. 9, drill. DD-692.
Approved.

El Camino Oil and Development Co.
Well No. 8, redrill. DD-526.
Well No. 10, redrill. DD-527.
Well No. 17, shut-off. D-774.

General Petroleum Corporation.
Well No. 12-A, redrill. DD-638.
Well No. 13-A, shut-off. D-278.

Dabney Oil Co.
Well No. 8, shut-off. D-677.
Depth of shut-off 300' lower than authorized, probably endangering upper oil zone.

SECTION 35.

Associated Oil Co.
Well No. 45, plug off bottom water. DD-220.
Well No. 45, abandon. DD-276.

SECTION 36.

American Oilfields Co.
Well No. 46, redrill. DD-657.
Well No. 55, redrill. DD-673.
Work completed before receipt of proposal not approved.
Well No. 55, redrill. DD-674.
Requested further information.
Well No. 55, deepen. DD-686.
Recommended test of water string.
Well No. 55, shut-off. D-806.
Recommended further tests.
Well No. 55, shut-off. D-838.
Reported satisfactory test.
Well No. 98, redrill. DD-223.
Well No. 101, shut-off. D-635.
Well No. 101, deepen. DD-744.

C. C. M. O. Co.
Well No. 18, shut-off. D-809.
Well No. 20, shut-off. D-627.
Well No. 21, shut-off. D-665.
Well No. 22, shut-off. D-640.
Well No. 23, shut-off. D-623.
Well No. 24, shut-off. D-675.
Well No. 25, shut-off. D-680.
Well No. 26, shut-off. D-651.
Well No. 27, shut-off. D-890.
Well No. 28, shut-off. D-720.
Well No. 28, redrill, plug bottom. DD-888.
Well No. 30, shut-off. D-834.
Well No. 31, shut-off. D-744.
Well No. 32, shut-off. D-878.
Well No. 34, shut-off. D-848.
Well No. 35, Shut-off. D-919.

T. 31 S., R. 23 E., M. D. B. & M.

SECTION 14.

Barnodon Oil Co.
Well No. 1, abandon. DD-714.

SECTION 19.

Union Oil Co.
Well No. 2, Midway Royal, shut-off. D-318.
Well No. 2, Midway Royal, shut-off. D-686.
Well No. 2, abandon. DD-761.
Well No. 3, shut-off. D-858.

Calidon Petroleum Syndicate.
Well No. 2, redrill and deepen. DD-237.
Well No. 2, shut-off. D-601.
Well No. 3, drill. DD-647.

SECTION 20.

Associated Oil Co.
Well No. 72, redrill. DD-582.
Well No. 72, shut-off. D-721.

SECTION 21.

Kern Trading and Oil Co.
Well No. 14, drill. DD-690.
Well No. 14, shut-off. D-912.
Well No. 23, drill. DD-677.
Well No. 24, drill. DD-678.

SECTION 22.

Standard Oil Co.
Well No. 5, shut-off. D-501.
Well No. 5, abandon. DD-704.
Approved with recommendations.
Well No. 7, redrill. DD-524.
Approved.
Well No. 7, abandon. DD-679.
Approved with recommendations.
Well No. 11, shut-off. D-530.

Associated Oil Co.
Well No. 3, shut-off. D-313.
Well No. 3, shut-off. D-522.
Well No. 3, shut-off. D-550.
Well No. 63, test 8" casing. DD-249.
Well No. 63, abandon lower portion. DD-259.
Approved.
Well No. 63, deepen. DD-303.
Approved.
Well No. 63, shut-off. D-659.
Approved for the purpose of prospecting ahead.

SECTION 24.

Union Oil Co.
Well No. 1, Barnodon, abandon. DD-293.

San Francisco Midway Oil Co.
Well No. 2, redrill. DD-780.
Well No. 2, shut-off. D-843.

SECTION 25.

Kern Trading and Oil Co.
Well No. 9, shut-off. D-791.
Well No. 10, shut-off. D-287.
Well No. 13, shut-off. D-273.
Well No. 21, drill. DD-685.

SECTION 26.

Associated Oil Co.
Well No. 6, shut-off. Letter 10/16/16.
Well No. 6, shut-off. D-514.
Well No. 34, test 10" casing. DD-248.
Well No. 34, shut-off. D-345.
Well No. 44, shut-off. D-704.
Well No. 44, drill. Letter 5/18/17.
Well No. 73, drill. DD-337.
Well No. 73, shut-off. Letter 11/29/16.
Well No. 73. D-567.
Well No. 83, shut-off. D-266.
Well No. 93, deepen. DD-560.

Standard Oil Co.
Well No. 12, shut-off. D-245.
Well No. 13, redrill and deepen. DD-903.
Well No. 14, shut-off. D-374.
Well No. 15, shut-off. D-349.
Well No. 16, shut-off. D-549.
Well No. 17, shut-off. D-593.
Well No. 19, shut-off. D-619.
Well No. 19, redrill. DD-583.

SECTION 27.

Kern Trading and Oil Co.
Well No. 2, redrill. DD-332.
Approved proposal to repair in satisfaction of complaints of neighbors. (See informal complaints.)
Well No. 25, shut-off. D-798.
Well No. 28, shut-off. D-755.
Well No. 31, shut-off. D-792.

Midway Gas Co.
Well No. 27, drill. DD-698.

SECTION 31.

C. C. M. O. Co.
Well No. 16, shut-off. D-515.
Well No. 17, shut-off. D-582.
Well No. 18, shut-off. D-676.
Well No. 18, redrill. DD-671.
Well No. 19, shut-off. D-657.
Well No. 20, shut-off. D-731.
Well No. 20, redrill. DD-889.
Well No. 21, shut-off. D-718.
Well No. 21, redrill. DD-634.
Well No. 22, shut-off. D-663.
Well No. 23, shut-off. D-738.
Well No. 23, redrill. DD-635.
Well No. 23, shut-off. D-862.
Well No. 24, shut-off. D-734.
Well No. 24, redrill. DD-636.

C. C. M. O. Co.
Well No. 24, shut-off. D-794.
Well No. 26, shut-off. D-789.
Well No. 27, shut-off. D-728.
Well No. 29, shut-off. D-852.
Well No. 30, shut-off. D-817.
Well No. 31, shut-off. D-814.

Standard Oil Co.
Well No. 11, Eagle Creek, redrill. DD-848.
Well No. 12, Eagle Creek, shut-off. D-298.
Well No. 17, Eagle Creek, redrill. DD-591.
Well No. 17, shut-off. D-769.
Well No. 18, Eagle Creek, shut-off. D-790.
Well No. 19, Eagle Creek, shut-off. D-759.
Well No. 20, Eagle Creek, shut-off. D-830.
Well No. 20, Eagle Creek, redrill. DD-902.
Well No. 21, Eagle Creek, redrill. DD-811.
Recommended test of water string and furnished company copy of log.
Well No. 22, Eagle Creek, drill. DD-850.

Honolulu Consolidated Oil Co.
Well No. 10, redrill. DD-346.

SECTION 32.

California Midway Oil Co.
Well No. 10, shut-off. D-243.
Well No. 10, test by pumping. DD-219.
Well No. 10, deepen. DD-329.
Well No. 10, redrill. DD-904.

Pacific Crude Oil Co.
Well No. 1, redrill. DD-217.

Alaska Pioneer Oil Co.
Well No. 4, abandon. DD-331.
Well No. 8, drill. Letter 11/7/16.
Well No. 8, shut-off. D-607.
Well No. 8, redrill. DD-564.
Well No. 8, redrill. DD-660.
Well No. 8, deepen. DD-768.
Well No. 10, redrill and deepen. DD-156.

SECTION 33.

Kern Trading and Oil Co.
Well No. 7, redrill. DD-606.
Well No. 10, shut-off. D-668.

SECTION 34.

Associated Oil Co.
Well No. 91, shut-off. D-281.

SECTION 35.

Kern Trading and Oil Co.
Well No. 1, deepen. DD-604.
Well No. 23, shut-off. D-669.
Well No. 24, shut-off. D-702.
Well No. 25, shut-off. D-644.
Well No. 27, shut-off. D-520.

SECTION 36.

Standard Oil Co.
Well No. 5, McNee, redrill. DD-726.
Well No. 12, McNee, redrill and deepen. DD-531.

Standard Oil Co.
Well No. 14, McNee, deepen. DD-727.
Well No. 20, McNee, redrill and deepen. DD-575.
Well No. 25, McNee, deepen. DD-728.
Well No. 38, McNee, shut-off. D-303.
Well No. 42, shut-off. D-261.
Well No. 43, McNee, shut-off. D-334.
Well No. 43, McNee, redrill. DD-538.
Well No. 43, McNee, deepen. DD-894.
Well No. 44, shut-off. D-517.
Well No. 45, McNee, shut-off. D-315.
Well No. 45, McNee, deepen. DD-862.
Well No. 46, McNee, shut-off. D-343.
Well No. 47, McNee, shut-off. D-693.
Well No. 48, shut-off. D-503.
Well No. 49, shut-off. D-546.
Well No. 50, McNee, shut-off. D-568.
Well No. 50, McNee, redrill. DD-522.
Well No. 50, McNee, shut-off. D-678.
Well No. 51, McNee, shut-off. D-638.
Well No. 52, McNee, shut-off. D-672.
Well No. 52, deepening. DD-585.
Well No. 52, deepen. DD-593.
Well No. 53, McNee, shut-off. D-565.
Well No. 54, McNee, shut-off. D-795.
Well No. 55, shut-off. D-885.
Well No. 56, McNee, shut-off. D-841.
Well No. 57, McNee, begin drilling. DD-779.

T. 31 S., R. 24 E., M. D. B. & M.

SECTION 31.

Kern Trading and Oil Co.
Well No. 10, shut-off. D-618.

T. 31 S., R. 32 E., M. D. B. & M.

SECTION 36.

C. C. M. O. Co.
Well No. 36, shut-off. D-845.

T. 32 S., R. 22 E., M. D. B. & M.

SECTION 1.

C. C. M. O. Co.
Well No. 20, shut-off. D-617.

Chanslor-Canfield Co.
Well No. 21, shut-off. D-641.
Well No. 22, shut-off. D-642.

Chanslor-Canfield Midway Oil Co.
Well No. 23, shut-off. D-667.
Well No. 23, redrill. DD-656.
Well No. 23, shut-off. D-788.

T. 32 S., R. 23 E., M. D. B. & M.

SECTION 1.

Kern Trading and Oil Co.
Well No. 32, shut-off. D-296.
Well No. 36, shut-off. D-388.
Well No. 37, shut-off. D-347.
Well No. 41, begin drilling. DD-795.
Well No. 56, begin drilling. DD-796.
Well No. 57, begin drilling. DD-797.
Well No. 58, begin drilling. DD-798.
Well No. 59, begin drilling. DD-799.
Well No. 59, shut-off. D-924.

SECTION 2.

North American Oil Consolidated.
Well No. 7, redrill. DD-803.
Well No. 10, redrill. DD-802.

SECTION 3.

Kern Trading and Oil Co.
Well No. 11, shut-off. D-609.

SECTION 4.

California Counties Oil Co.
Well No. 1, deepen. DD-382.

Canadian Pacific Oil Co.
Well No. 4, begin drilling. DD-289.
Well No. 4, shut-off. D-541.

Standard Oil Co.
Well No. 7, Equitable, redrill. DD-523.
Well No. 7, Equitable, shut-off. D-831.

Midway Consolidated Co.
Well No. 6, shut-off. D-548.
Well No. 6, shut-off. D-594.

SECTION 5.

Kalispell Oil Co.
Well No. 2, abandon. DD-765.
See Complaint No. 11.
Well No. 2, shut-off. D-914.

Midway Premier Oil Co.
Well No. 13, redrill. DD-239.
Well No. 13, shut-off. D-367.

Midway Five Oil Co.
Well No. 7, shut-off. D-297.

SECTION 6.

Chanslor-Canfield Midway Oil Co.
Well No. 25, redrill. DD-373.
Well No. 41, abandon. DD-372.
Well No. 41, shut-off. D-583.
Well No. 45, abandon. DD-379.
Well No. 46, shut-off. D-380.
Well No. 46, abandon. DD-359.
Well No. 47, shut-off. D-382.
Well No. 48, shut-off. D-386.
Well No. 49, shut-off. D-521.

Chanslor-Canfield Midway Oil Co.
Well No. 49, abandon. DD-360.
Well No. 50, shut-off. D-534.
Well No. 50, abandon. DD-361.
Well No. 51, shut-off. D-538.
Well No. 52, shut-off. D-535.
Well No. 53, shut-off. D-584.
Well No. 54, shut-off. D-543.
Well No. 55, shut-off. D-613.
Well No. 56, shut-off. D-739.
Well No. 57, shut-off. D-779.
Well No. 58, shut-off. D-639.
Well No. 58, redrill. DD-782.
Well No. 58, shut-off. D-891.
Well No. 59, begin drilling. DD-739.
Well No. 59, shut-off. D-904.
Well No. 60, shut-off. D-671.
Well No. 61, begin drilling. DD-740.
Well No. 61, shut-off. D-853.
Well No. 62, begin drilling. DD-741.
Well No. 63, begin drilling. DD-742.
Well No. 63, shut-off. D-905.

United Oil Co.
Well No. 2-A, redrill. DD-325.
Well No. 3, redrill. DD-891.
Well No. 6, redrill. DD-648.
Well No. 6, redrill. DD-870.
Well No. 7, shut-off. D-502.
Well No. 7, redrill. DD-324.

SECTION 8.

Hale-McLeod Oil Co.
Well No. 17, shut-off. D-293.
Well No. 18, shut-off. D-368.
Well No. 19, shut-off. D-572.
Well No. 20, shut-off. D-689.

Chanslor-Canfield Midway Oil Co.
Well No. 26, shut-off. D-504.

SECTION 9.

Chanslor-Canfield Midway Oil Co.
Well No. 19, shut-off. D-321.

SECTION 10.

Standard Oil Co.
Well No. 8, Equitable, shut-off. D-302.
Well No. 11, shut-off. D-539.

SECTION 12.

Standard Oil Co.
Well No. 8, redrill. DD-574.

SECTION 14.

Union Oil Co. of Cal.
Well No. 1, redrill. DD-318.
Well No. 4, begin drilling. DD-781.
Well No. 6, Regal, deepen. DD-245.
Well No. 6, Regal, deepen. DD-343.
Well No. 6, Regal, shut-off. D-620.
Well No. 8, Regal, deepen. DD-246.

Standard Oil Co.
Well No. 13, shut-off. D-608.
Well No. 13, shut-off. D-706.
Well No. 13, pass for pumping test. DD-696.

SECTION 15.

Empire Gas and Fuel Co.
Well No. 2, abandon. DD-227.
Well No. 3, redrill. DD-867.
Well No. 4, shut-off. D-518.
Well No. 4, shut-off. D-570.
Well No. 4, deepen. DD-668.

SECTION 17.

Chanslor-Canfield Midway Oil Co.
Well No. 23, redrill. DD-374.
Well No. 24, redrill. DD-312.

SECTION 22.

Indian and Colonial Development Co.
Well No. 1, shut-off. D-876.
Well No. 1, shut-off. D-874.
Well No. 2, shut-off. D-875.
Well No. 23, shut-off. D-877.

Fairbanks Oil Co.
Well No. 11, shut-off. D-748.
Well No. 12, commence drilling. DD-855.

SECTION 23.

Traders Oil Co.
Letter Dec. 14, 1916. Shut-off.
Well No. 71, redrill. DD-280.
Well No. 71, shut-off. D-870.
Well No. 73, shut-off. D-872.
Well No. 74, shut-off. D-907.
Well No. 75, shut-off. D-901.
Well No. 76, shut-off. D-899.
Well No. 78, shut-off. D-871.
Well No. 79, shut-off. D-892.
Well No. 80, shut-off. D-921.
Well No. 81, shut-off. D-869.
Well No. 82, shut-off. D-873.
Well No. 106, shut-off. D-323.
Well No. 106, locate water. DD-357.
Well No. 106, shut-off. D-691.
Well No. 106, shut-off. D-717.

Cheney Stimson Oil Co.
Well No. 2, shut-off. D-893.
Well No. 6, shut-off. D-664.

SECTION 24.

Jameson Oil Co.
Well No. 6, shut-off. D-855.
Well No. 14, shut-off. D-751.
Well No. 16, commence drilling. DD-892.

SECTION 25

T. W. Co.
Well No. 1, redrill. DD-334.
Well No. 4, redrill. DD-341.

Princeton Oil Co.
Well No. 5, abandon. DD-869.

General Pet. Co.
Well No. 43, shut-off. D-577.
Well No. 44, shut-off. D-526.

B. H. & C. Oil Co.
Well No. 1, redrill. DD-251.

Tamalpais Oil Co.
Well No. 3, shut-off. D-272.

SECTION 26

Mascot Oil Co.
Well No. 11, redrill. DD-321.
Well No. 24, redrill. DD-242.
Well No. 27, redrill. DD-241.
Well No. 30, redrill. DD-338.
Well No. 44, shut-off. D-564.
Well No. 45, shut-off. D-581.
Well No. 46, shut-off. D-630.
Well No. 48, shut-off. D-616.
Well No. 49, shut-off. D-631.
Well No. 50, shut-off. D-666.
Well No. 51, shut-off. D-679.

Associated Oil Co.
Well No. 1, begin drilling. DD-672.
Well No. 25, redrill. DD-626.
Well No. 25, shut-off. D-732.
Well No. 42, make formation shut-off. DD-584.
Well No. 42, redrill (plug bottom). DD-884.
Well No. 53, North Am., shut-off. D-684.
Well No. 58, redrill. DD-627.

North American Consolidated Co.
Well No. 58, shut-off. D-309.
Well No. 64, shut-off. D-259.

Mt. Diablo Oil, Mining and Development Co.
Well No. 5, shut-off. D-274.
Well No. 5, shoot. DD-250.

Dunlop Oil Co.
Well No. 9, commence drilling. DD-863.

SECTION 36.

Associated Oil Co.
Well No. 1, shut-off. D-778.
Well No. 1, shut-off. D-810.

T. 32 S., R. 24 E., M. D. B. & M

SECTION 6.

Honolulu Cons. Oil Co.
Well No. 3, redrill. DD-762.
Well No. 4, redrill. DD-339.
Well No. 4, abandon. DD-573.
Well No. 5, deepen. DD-895.

SECTION 7.

Kern Trading and Oil Co.
Well No. 31, shut-off. D-842.

Midway Gas Co.
Well No. 35, shut-off. D-711.

SECTION 8.

Honolulu Oil Co.
Well No. 9, shut-off. D-590.

SECTION 9.

Kern Trading and Oil Co.
Well No. 12, deepen. DD-603.
Well No. 16, shut-off. D-897.
Well No. 20, shut-off. D-330.
Well No. 20, shut-off. D-701.
Well No. 20, redrill. DD-599.
Well No. 21, shut-off. D-886.
Midway Gas Co.
Well No. 3, shut-off. D-574.
Well No. 60, begin drilling. DD-697.

SECTION 10.

Honolulu Oil Co.
Well No. 9, shut-off. D-305.
Well No. 9, plug off bottom water. DD-265.
Honolulu Cons. Oil Co.
Well No. 9, shut-off. D-357.
Well No. 10, shut-off. D-379.
Well No. 11, shut-off. D-681.

SECTION 12.

Honolulu Oil Co.
Well No. 2, shut-off. D-606.

SECTION 14.

Honolulu Cons. Oil Co.
Well No. 2, redrill. DD-592.
Well No. 2, redrill. DD-631.
Well No. 2, shut-off. D-847.

SECTION 15.

Kern Trading and Oil Co.
Well No. 1, shut-off. D-742.
Well No. 5, shut-off. D-254.
Well No. 6, shut-off. D-255.

SECTION 16.

Standard Oil Co.
Well No. 2, shut-off. D-355.
Well No. 5, Derby, redrill and deepen. DD-544
Well No. 14, Derby, redrill. DD-362.
Well No. 15, shut-off. D-262.
Well No. 17, shut-off. D-339.
Well No. 18, shut-off. D-292.
Well No. 19, shut-off. D-333.
Well No. 20, Derby, shut-off. D-662.
Well No. 21, Derby, shut-off. D-603.
Well No. 21, Derby, redrill. DD-561.
Well No. 21, shut-off. D-767.
Well No. 22, Derby, shut-off. D-643.
Well No. 23, shut-off. D-736.
Well No. 24, Derby, begin drilling. DD-786
Well No. 26, Derby, begin drilling. DD-787.

St. Helens Pet. Co., Ltd.
Well No. 5, deepen. DD-277.
Well No. 9, redrill. DD-551.
Well No. 17, shut-off. D-336.
Well No. 18, shut-off. D-378.
Well No. 20, shut-off. D-764.
Well No. 20, shut-off. D-765.
Well No. 21, begin drilling. DD-720.
Well No. 21, shut-off. D-854.
Well No. 21, redrill. DD-842.

Southern California Gas Co.
Well No. 4, shut-off. D-291.
Well No. 5, shut-off. D-310.
Well No. 6, shut-off. D-611.
Well No. 6, redrill. DD-629.
Approved proposal to make tests to determine source of water. See Complaint No. 25.

Petroleum Midway Co., Ltd.
Well No. 1, redrill. DD-231.
Well No. 4, redrill. DD-841.
Well No. 6, deepen. DD-252.
Well No. 7, shut-off. D-329.
Well No. 7, shut-off. D-356.
Well No. 8, shut-off. D-304.
Well No. 8, shut-off. D-604.
Well No. 9, abandon. DD-791.
Well No. 9-A, commence drilling. DD-851.
Well No. 10, shut-off. D-519.

SECTION 17.

Kern Trading and Oil Co.
Well No. 10, commence drilling. DD-836.
Well No. 25, begin drilling. DD-687.
Well No. 27, shut-off. D-828.
Well No. 29, shut-off. D-575.
Well No. 29, redrill and deepen. DD-881.
Well No. 30, make deeper shut-off. DD-348.
Well No. 30, shut-off. D-576.

SECTION 18.

Standard Oil Co.
Well No. 1, abandon. DD-340.
Well No. 8, redrill. DD-255.
Well No. 9, redrill. DD-270.
Well No. 9, redrill. DD-580.
Well No. 10, shut-off. D-508.
Well No. 14, shut-off. D-529.
Well No. 14, redrill. DD-590.
Well No. 15, shut-off. D-389.
Well No. 15, shut-off bottom water. DD-730.
Well No. 16, shut-off. D-632.
Well No. 16, redrill and deepen. DD-746.
Well No. 17, shut-off. D-930.
Well No. 17, begin drilling. DD-788.
Well No. 18, shut-off. D-745.
Well No. 19, begin drilling. DD-785.
Well No. 20, begin drilling. DD-840.

SECTION 19.

Kern Trading and Oil Co.
Well No. 9, deepen and redrill. DD-267.
Well No. 9, shut-off. D-537.
Well No. 21, abandon. DD-887.
Well No. 31, shut-off. D-766.
Well No. 32, shut-off. D-813.
Well No. 33, commence drilling. DD-837.
Well No. 37, commence drilling. DD-838.

SECTION 20

Standard Oil Co.
Well No. 8, shut-off. D-636.
Well No. 10, redrill. DD-587.

SECTION 22.

Maricopa Investment Co.
Well No. 1, Luxor, abandon. DD-244.

SECTION 24.

Honolulu Cons. Oil Co.
Well No. 1, abandon. DD-681.
Well No. 2, abandon. DD-682.
Well No. 3, abandon. DD-683.

SECTION 28.

Standard Oil Co.
Well No. 6, redrill. DD-586.
Well No. 9, shut-off. D-528.

SECTION 30.

Well No. 14, redrill. DD-582.
Well No. 27, shut-off. D-658.
Well No. 28, shut-off. D-733.
Well No. 29, shut-off. D-819.

This well was later redrilled to protect and produce an oil sand cased off behind the water string. This sand was at last reports producing at the rate of 50 bbls. per day. It is our understanding that the work was done as a result of the recommendations of Mr. R. Stoner, the company geologist.

SECTION 32.

American Oilfields Co.
Well No. 12, redrill. DD-662.

General Petroleum Corporation.
Well No. 14, redrill. DD-304.

Edmonds Midway Co.
Well No. 4, shut-off. D-252.

SECTION 33.

Kern Trading and Oil Co.
Well No. 21, deepen. DD-602.

T. 11 N., R. 23 W., S. B. B. & M.

SECTION 4.

Union Oil Co.
International No. 5, drill new well. DD-238.
International No. 5, drill. DD-258.
Method described under subheading "Sunset Field."
International No. 5, shut-off. D-506.

Union Oil Co.
International No. 5, shut-off. D-599.
International No. 5, redrill. DD-521.
International No. 5, shut-off. D-723.
International No. 5, shut-off. D-724.
International No. 5, shut-off. D-784.
International No. 6, redrill. DD-754.

The proposal of the company was to drill this well with a top water shut-off at 3100 ft., thus passing up the upper oils known to exist in the district. The above report recommended landing the 10" casing at 2714 ft., and mudding under a pressure each sand below, to a depth of 3115 ft., and cementing at that depth. The company objected to the ruling and a conference between officials of the company and the State Oil and Gas Supervisor and his deputies was held at Los Angeles, which resulted in a decision to hold a public hearing at Taft on July 27, 1917. The hearing was held on the date set and a great amount of testimony was offered. The operators present were practically unanimous in agreeing that if mudding to protect sands was permitted at all, it should only be permitted after the top water had been cased off by means of metal pipe. Transcript of the hearing is on file at the office of the Supervisor. As a result of the conference, the Department reported as follows:

"At your written request, a reconsideration of our report No. DD-754 was given at the public conference at Taft on July 27, 1917. This report amends and supersedes said report.

"The proposal to drill this well by landing the 10" water string at 3100' is rejected.

"This Department recommends and requires:

"First: That the 10" casing be set and cemented in the hard, sandy blue shale between depths of 2647' and 2700' (as shown in the log of Well No. 2). The shut-off shall be witnessed by the department in the usual manner.

"Second: That the hole be drilled in such a manner as to definitely locate the sands logged in well No. 2 between depths of 2700' and 2742'. When such sands are located they be mudded under pressure of 400 pounds per square inch with thin mud until no more mud can be pumped in, and drilling then continued through the flowing water expected between depths of about 3071' and 3111'. In said continued drilling each sand as encountered shall be thoroughly filled with mud in the manner heretofore set forth.

"Third: The 8¼" casing shall be landed and cemented at least 50 feet below the aforesaid flowing water. In cementing the 8¼" casing enough cement shall be used to extend up to the shoe of the 10" casing (estimated to be from 50 to 150 sacks). Said cementing of 8¼" casing to be witnessed by a representative of this department.

"Fourth: Test of shut-off by 8¼" casing to be witnessed in the usual manner."

The well was finally completed in accordance with the recommendations of the State Mining Bureau, and is proving a good producer.

Lake View No. 2 Oil Co.
Well No. 1, redrill. DD-208.
Approved proposal.
Well No. 1, redrill. DD-769.
Approved amended proposal.

This work has since been completed and the well brought in producing clean oil from the sand from which it originally gushed. A great amount of time and money was spent in cleaning out the old 6¼" casing to shoot and plug it at a depth of 2920 ft. The hole was then redrilled from 2510' to 2950', and after shooting again at 2920', the new string of 6¼" casing was cemented at 2950' with 160 sacks of cement after mudding the hole under a pressure of 700 pounds per square inch. The management and local superintendent of the company deserve great credit for the complete success of the job.

Well No. 1, shut-off. D-864.
Well No. 3, redrill. DD-301.

Lake View No. 2 Oil Co.
Well No. 3, shut-off. D-750.
Well No. 3, shut-off. D-807.
Well No. 5, shut-off. D-286.
Well No. 7, shut-off. D-285.
Well No. 7, shut-off. D-509.
Well No. 9, shut-off. D-505.
Well No. 9, shut-off. D-628.
Well No. 9, deepen. DD-588.
Well No. 11, begin drilling. DD-666.

Pat Welch.
Well No. 3, shut-off. D-375.
Well No. 4, begin drilling. DD-311.
Well No. 4, drill. DD-525.
Well No. 4, shut-off. D-725.
Well No. 4, shut-off. D-768.
Well No. 4, shut-off. D-782.
Well No. 4, redrill. DD-734.
Well No. 4, shut-off. D-818.
Well No. 4, shut-off. D-825.
Well No. 4, redrill. DD-758.
Well No. 4, shut-off. D-895.
Well No. 4, shut-off. D-837.

Interstate Oil Co.
Well No. 10, concerning method of drilling. DD 349.
Well No. 10, deepen. DD-518.
Well No. 10, shut-off. D-726.
Well No. 10, deepen. DD-755.
Well No. 12, shut-off. D-747.
Well No. 14, begin drilling. DD-766.

SECTION 5.

Kern Trading and Oil Co.
Well No. 3, abandon. DD-651.
Well No. 29, begin drilling. DD-675.
Well No. 31, begin drilling. DD-386.
Well No. 31, shut-off. D-722.
Well No. 31, shut-off. D-793.

SECTION 6.

General Petroleum Co.
Well No. 5-B, redrill. DD-375.

General Petroleum Corp.
Well No. 5-B, abandon. DD-847.
Well No. 6-B, redrill. DD-305.
Well No. 6-B, redrill. DD-702.
Well No. 7-B, abandon. DD-846.
Well No. 13-B, shut-off. D-383.
Well No. 13-B, abandon. DD-381.

Bankline Oil Co.
Well No. 5, shut-off. D-373.
Well No. 5, redrill. DD-637.
Approved.
This well was later abandoned and converted into a water well. In this work an interesting discovery was made. After completing the plugging from the bottom up into the "water string" to a depth of about 2200′, the water string was perforated between depths of 500′ and 1000′ before bailing, and it was found that oil sand was coming into the well through the perforations in the water string.

H. H. Hart & H. M. Payne.
Well No. 1, begin drilling. DD-733.

SECTION 7.

Standard Oil Co.
Well No. 2, Monarch, commence drilling. DD-843.
Well No. 2, Monarch, shut-off. D-888.

SECTION 8.

Sunset Extension Oil Co.
Well No. 1, redrill. DD-689.
Well No. 1, shut-off. D-900.

Nellie Adamson.
Well No. 2, Midway Southern, abandon. DD-839.
Rejected for lack of log. This is one of several applications to abandon wells made by "homesteaders" who, after certain formalities, laid claim to pipe beneath the ground, as well as to surface rights.

Bronco Lease (W. G. Kerckhoff).
Well No. 1, redrill. DD-676.
Well No. 1, redrill. DD-722.

SECTION 17.

Hazleton Crude Oil Co.
Well No. 1, abandon. DD-387.
Well No. 1, shut-off. D-690.

SECTION 35.

J. F. Lingo Co.
Well No. 1, abandon. DD-752.
This work was begun without notice to the department and as the result of a "homesteader" laying claim to the pipe in the well.

T. 11 N., R. 24 W., S. B. B. & M.

SECTION 1.

Standard Oil Co.
Well No. 1, Maricopa, shut-off. D-260.
Well No. 6, Maricopa, redrill and deepen. DD-530.
Well No. 6, shut-off. D-727.
Well No. 6, Maricopa, shut-off. D-868.
Well No. 15, redrill. DD-352.
Well No. 22, Maricopa, shut-off. D-263.
Well No. 22, redrill. DD-356.
Well No. 23, Maricopa, redrill. DD-549.
Well No. 23, shut-off. D-673.
Well No. 24, shut-off. D-344.
Well No. 25, Maricopa, shut-off. D-692.
Well No. 26, Maricopa, begin drilling. DD-767.
Well No. 26, shut-off. D-887.

Lowell Oil Co.
Well No. 1, deepen. DD-383.
Well No. 1, abandon. DD-748.
Well No. 11, redrill. DD-350.

SECTION 2.

McCutcheon Bros.
Well No. 3, locate and shut off water. DD-333.
Well No. 8, deepen. DD-330.

Anchor Oil Co.
Well No. 17, redrill. DD-565.

United Oil Co.
Well No. 1, redrill and deepen. DD-328.
Well No. 2, redrill. DD-652.
Well No. 4, shut-off. D-580.

Heard & Painter.
Well No. 5, shut-off. D-773.

Ida May Oil Co.
Well No. 5, commence drilling. DD-864.

Ruby Oil Co.
Well No. 4, redrill. DD-743.
Well No. 10, redrill. DD-566.

Standard Oil Co.
Well No. 36, Sunset Monarch, shut-off. D-829.
Well No. 13 (Monarch), redrill. DD-750.
Well No. 36 (Monarch), begin drilling. DD-784.
Well No. 37 (Monarch, Sec. 2), commence drilling. DD-898.
Well No. 38 (Monarch), commence drilling. DD-899.
Well No. 23, redrill. DD-384.

SECTION 12.

Good Roads Oil Co.
Well No. 7, redrill. DD-548.
Well No. 7, shut-off. D-783.
Well No. 7, abandon. DD-749.
Well No. 7-A, begin drilling. DD-757.
Well No. 7-A, redrill. DD-905.

Walter Snook.
Well No. 2, redrill. DD-261.

Northern Oil Co.
Well No. 4, abandon. DD-229.

Petrolia Oil Co.
Well No. 5, shut-off. D-253.

T. 12 N., R. 23 W., S. B. B. & M.

SECTION 6.

Bankline Oil Co.
Well No. 4, shut-off. D-699.

Maricopa National Co.
Well No. 7, shut-off. D-561.

SECTION 30.

Whittaker, Doan and Laymance, H. M. Payne, Receiver.
Well No. 1, redrill. DD-274.

SECTION 31.

Kern Trading and Oil Co.
Well No. 2, shut-off. D-624.
Well No. 2, deepen. DD-605.
Well No. 8, deepen. DD-268.
Well No. 58, begin drilling. DD-807.
Well No. 59, begin drilling. DD-808.
Well No. 60, begin drilling. DD-809.
Well No. 61, begin drilling. DD-810.
Well No. 138, shut-off. D-908.

SECTION 32.

Spreckels Oil Co., H. M. Payne, Receiver.
Well No. 4, redrill and abandon lower part. DD-272.
Well No. 4, shut-off. D-531.
Well No. 5, redrill. DD-747.
Well No. 7, deepen. DD-273.

National Pacific Oil Co., H. M. Payne, Receiver.
Well No. 1, redrill. DD-308.

Pacific Midway Oil Co., H. M. Payne, Receiver.
Well No. 5, deepen. DD-271.
Well No. 5, shut-off. D-360.
Well No. 5, shut-off. D-552.

Midway Northern Oil Co.
Well No. 2, shut-off. D-525.
Well No. 3, shut-off. D-322.
Well No. 3, shut-off. D-364.
Well No. 3, shut-off. D-589.

General Petroleum Corp.
Well No. 4-A, redrill. DD-623.
Well No. 4-A, Annex, shut-off. D-805.

Obispo Oil Co.
Well No. 3, shut-off. D-308.
This test was made after the repair of the well while under the hands of the receiver. The trouble was overcome by replacing the 4½" casing, which had been eaten out by "bad water," with a new string which was cemented.
The test was satisfactory.

SECTION 34.

Comstock Crude Oil Co.
Well No. 1, redrill and deepen. DD-302.
Well No. 1, redrill. DD-516.
Well No. 1, redrill. DD-622.
Well No. 1, abandon. DD-794.
Well No. 1, abandon. DD-907.

T. 12 N., R. 24 W., S. B. B. & M.

SECTION 25.

Kern Trading and Oil Co.
Well No. 1, redrill. DD-650.
Well No. 11, abandon. DD-213.
Well No. 13, abandon. DD-212.

Union Oil Co.
Well No. 12, Lake View, abandon. DD-216.

SECTION 26.

Sunset-Monarch Oil Co.
Well No. G, shut-off. D-569.
Well No. 1, redrill. DD-358.
Well No. M, shut-off. D-316.

Standard Oil Co.
Well No. 6 (Monarch), abandon. DD-893.
Well No. 12 (S. Monarch), shut-off. D-816.

SECTION 32.

Mother Colony Oil Co.
Well No. 1, abandon. DD-601.

SECTION 35.

Midway Oil Co.
Well No. 9 (Sage), abandon. DD-789.

Midway Oil Co. (work done by Midway Supply Co.).
Well No. 11 (Sage), shut-off. D-918.
Well No. 11 (Sage), shut-off. D-861.
Well No. 11 (Sage), shut-off. D-866.
Well No. 11 (Sage), shut-off. D-894.
Well No. 11 (Sage), shut-off. D-898.
Well No. 11 (Sage), shut-off. D-902.

Midway Oil Co.
Well No. 11 (Webster), abandon. DD-770.
Well No. 11, abandon. DD-783.
Well No. 48, shut-off. D-710.
Well No. 61, drill. DD-774.
Well No. 61, shut-off. D-851.
Well No. 64, commence drilling. DD-872.
Well No. 65, commence drilling. DD-873.
Well No. 65, shut-off. D-913.

SECTION 36.

Standard Oil Co.
Well No. 1, redrill. DD-388.
Well No. 1 (M. & M.) shut-off. D-655.
Well No. 2, redrill. DD-389.
Well No. 5, abandon. DD-505.
Well No. 6, redrill. DD-502.
Well No. 8, redrill. DD-503.
Well No. 17 (M. J. M. & M.), redrill. DD-725.
Well No. 24, redrill and deepen. DD-256.
Well No. 24, redrill. DD-589.
Well No. 24 (M. J. M. & M.), redrill. DD-745.
Well No. 23 (M. & M.) shut-off. D-381.
Well No. 34, shut-off. D-656.
Well No. 34 (M. J. M. & M.), deepen and redrill. DD-550
Well No. 35 (M. J. M. & M.), shut-off. D-562.
Well No. 36 (M. J. M. & M.), shut-off. D-735.
Well No. 37 (M. J. M. & M.), shut-off. D-799.
Well No. 37 (M. J. M. & M.), redrill. DD-611.
Well No. 37 (M. J. M. & M.), shut-off. D-705.
Well No. 38, shut-off. D-785.
Well No. 39 (M. J. M. & M.), shut-off. D-780.
Well No. 40 (M. J. & M.), shut-off. D-867.
Well No. 41, (M. J. & M.) shut-off. D-823.

Ethel D. Co.
Well No. 31, shut-off. D-289.
Well No. 32, shut-off. D-533.
Well No. 33, shut-off. D-695.
Well No. 34, begin drilling. DD-732.

Maricopa 36 Oil Co.
Well No. 2, deepen. DD-610.

M. & T. Oil Co.
Well No. 3, redrill. DD-327.
Well No. 3, abandon. DD-800.
Well No. 3, shut-off. D-903.

CHAPTER V.

FRESNO COUNTY.

By R. D. BUSH, Deputy Supervisor.

The present deputy took charge of this office March 1, 1917, when Deputy Supervisor M. J. Kirwan was transferred to Los Angeles. The staff, besides the deputy, consists of an inspector and an office assistant. The inspector's duties consist of the compilation of data on various wells and localities, making of well sections, peg models, etc., and testing some of the wells for water shut-off.

Previous to October, 1916, the Lost Hills and Belridge fields were included in the Coalinga district, but were found to be more accessible from Taft.

During the past fiscal year the following notices were received and tests made by the Coalinga office:

114 notices of intention to drill new wells.
92 notices of redrilling to shut off water.
153 notices of redrilling or deepening to increase production.
47 notices of abandonment.
155 wells were tested for water shut-off.

In addition to the regular routine work of making detailed recommendations for drilling, abandonment, depth of water shut-off, and testing of water shut-off at the wells, several extensive investigations have been made in various parts of the field where water conditions are serious, and considerable work has been completed and is now in progress toward remedying these conditions. Improvement in conditions has been shown, and the near future will undoubtedly show a great deal more. The cases are reported in detail under the subject of Complaints.

GENERAL SUMMARY OF WATER CONDITIONS.

The following statistics compiled from reports by the companies to the State Mining Bureau show the amounts of water and oil produced in the Coalinga field in June, 1917, as compared with June, 1916.

Production in Barrels, Month of June, 1916 and 1917. Coalinga Field.

	West Side			East Side			Total field		
	Oil	Water	Per cent water	Oil	Water	Per cent water	Oil	Water	Per cent water
June, 1916	482,997	195,865	28.9	715,910	61,893	7.95	1,198,907	257,758	17.7
June, 1917	457,613	219,718	32.4	824,989	93,420	10.3	1,282,602	313,138	19.6

Wells Producing and Average Production per Well per Day (Barrels). Coalinga Field.

	West Side			East Side			Total field		
	Oil	Water	Wells producing	Oil	Water	Wells producing	Oil	Water	Wells producing
June, 1916	27.9	11.3	576	72.1	6.2	331	44.0	9.5	907
June, 1917	25.8	12.4	589	63.2	7.5	415	42.6	10.4	1,004

The increase in the percentage of water being produced is accounted for by the fact that a number of previously idle wells producing a large quantity of water and a small quantity of oil are now being pumped. Formerly the production from these wells did not pay for the cost of operation, but the increase in the price of oil now makes them profitable. One property on the West Side, idle in 1916, produced in June, 1917, 4500 barrels of fluid, 90% water, from twelve wells. Resumption of operations at such properties now affords opportunities to profitably repair them.

A further indication of the water conditions in the Coalinga field is shown by the following division of the wells into three classes, namely, those that produce daily from 0 to 20 barrels, 20 to 40 barrels, and more than 40 barrels of water, and the same classification for oil.

Classification of Wells by Daily Production of Water (Barrels).

	West Side			East Side			Total field		
	0-20	20-40	40	0-20	20-40	40	0-20	20-40	40
Percentage of total producing wells	85.2	5.3	9.5	92.2	3.9	3.9	88	4.7	7.3

Classification of Wells by Daily Production of Oil (Barrels).

	West Side			East Side			Total field		
	0-20	20-40	40	0-20	20-40	40	0-20	20-40	40
Percentage of total producing wells	54.5	26.1	19.4	30.1	21.2	48.7	44.7	24.2	31.1

The number of wells in this district and the number of logs on file is shown by the following tabulation. The number of graphic logs already completed is also shown in the tabulation:

Field	Wells listed	Logs filed	Graphic logs
Coalinga	1,443	1,265	297

Peg models covering about 2570 acres, or 20% of the proven land in the district, have been constructed.

COMPLAINTS.

Complaint No. 1.

Creme Petroleum Company, Section 30, Township 20 South, Range 15 East, M. D. B. & M.

Efforts to have the owners of the Creme property repair Well No. 1 having failed, a detailed investigation of all surrounding wells was started in September, 1916, with a view to issuing a formal order or orders by the State Supervisor to remedy the water condition. After a complete review of the production and histories of about twenty-three surrounding wells, it was decided that more exact information as to production and fluid levels was needed, and, accordingly, on February 13, 1917, Order No. 1 was issued to the American Petroleum Company, Nevada Petroleum Company, and the Kern Trading and Oil Company, to make accurate determinations of fluid level and daily production of seventeen wells. This included thirteen American Petroleum wells, one Nevada Petroleum Company well, and three Kern Trading and Oil Company wells. This department also had samples of water from nine of these wells analyzed, and constructed a peg model covering an area of about 860 acres in this vicinity and showing one hundred wells. As a result of this investigation, it seemed that, while there was a possibility of more than one well contributing to the water trouble, Creme No. 1 was the worst offender, and, accordingly on June 2, 1917, an order was issued to the Creme Petroleum Company to repair the well according to the requirements of this department. By the end of June, arrangements were completed by the company for doing the work.

ORDER NUMBER ONE,
BY
STATE OIL AND GAS SUPERVISOR R. P. McLAUGHLIN,
DATED FEBRUARY 13, 1917,
RELATIVE TO
CREME PETROLEUM OIL COMPANY WELL No. 1,
Sec. 30, T. 20 S., R. 15 E., M. D. B. & M.
IN THE
COALINGA OIL FIELD OF CALIFORNIA.

To Creme Petroleum Company,
Mrs. Clara Curry, Tulare, Tulare Co., Cal.
William L. McGuire, San Francisco, Cal.
American Petroleum Company.
Nevada Petroleum Company.
Kern Trading & Oil Company.

Map accompanying order by
State Oil and Gas Supervisor,
R. P. McLaughlin
dated Feb. 13th, 1917
relative to
CREME PETROLEUM WELL NO. 1
Sec. 30, T 20S., R. 15 E., M. D. B. & M.
in the Coalinga Oil Field.
California

Average amounts of OIL produced daily
by various wells in December 1916

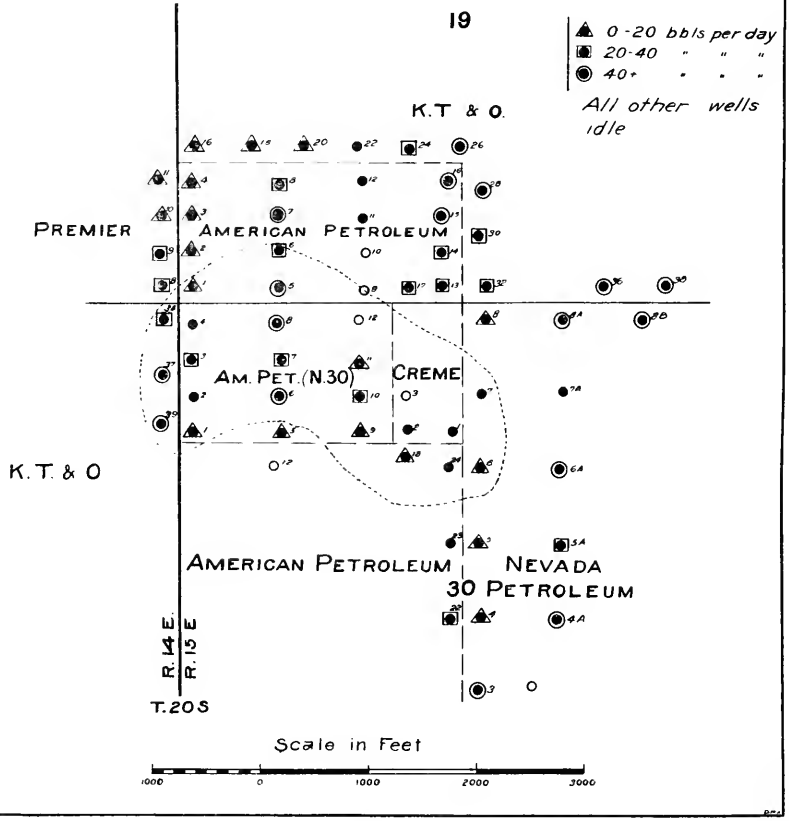


FIG. 25.

Map accompanying order by
State Oil and Gas Supervisor,
R P McLaughlin
dated Feb 13th, 1917
relative to
CREME PETROLEUM WELL NO. 1
Sec. 30. T 20 S., R. 15 E., M.D. B.&M
in the Coalinga Oil Field
California

Average amounts of Water produced daily by various wells in December 1916

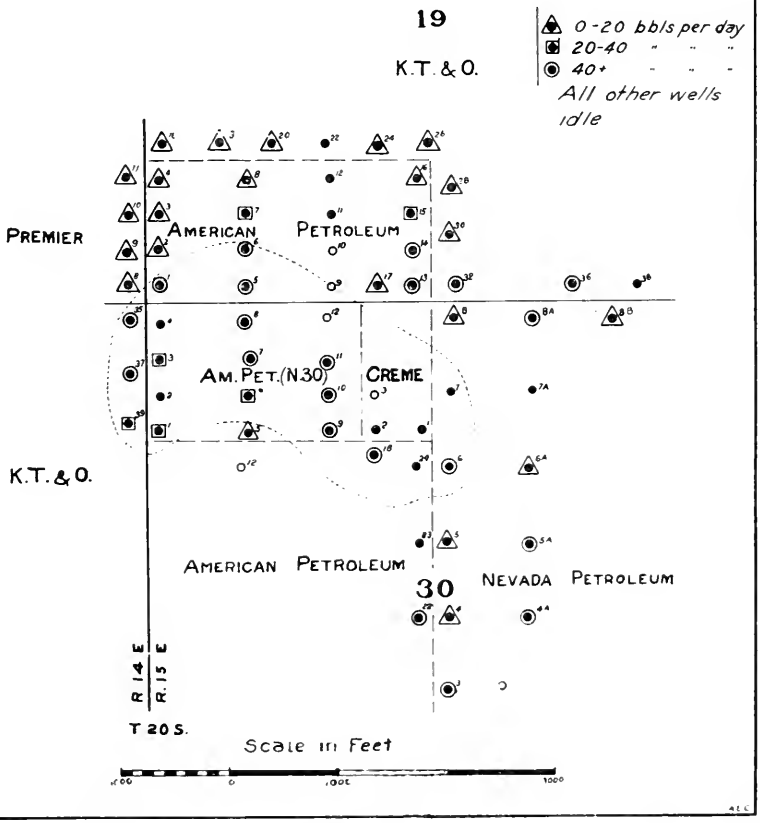


FIG. 26.

It appearing to the Supervisor that written complaints signed by more than one-third of the individuals or corporations owning land, or operating wells within the radius of one mile of a certain well known and designated as Creme Petroleum Well No. 1, situated in the northeast quarter of the northwest quarter of section 30, T. 20 S., R. 15 E., M. D. B. & M., pursuant to section 11, chapter 718, Statutes of 1915, said Supervisor has caused an investigation to be made and has determined that the following condition exists:

Water in excessive and damaging quantities is at present entering the oil sands of several wells situated within a radius of approximately one-half mile from the Creme Petroleum Well No. 1.

The excessive amount of water is probably due to improper conditions existing at more than one well in the area mentioned. Relief can only be had by treating all the wells under a single comprehensive plan, for the reason that they are intimately related underground.

The investigation began with the assumption that the damaging conditions complained of were local to the immediate vicinity of the Creme Petroleum Well No. 1, but it shortly appeared that the conditions were widespread. Forty-nine wells in the neighborhood, producing a total of 1822 barrels of oil and 2996 barrels of water per day, (nearly two barrels of water to one of oil). The scope of the examination was therefore extended to cover some sixty-three wells which are listed herewith, together with figures showing the average of daily amounts of oil and of water produced by each well.

These figures are for the month of December, 1916, unless otherwise noted. The tabulation also shows the number of days each well produced during the month.

Premier Oil Company.

(Sec. 24, T. 20 S., R. 14 E.)

Well number	Days	Barrels oil	Barrels water	
8	6	23	4	
9	6	39	1	
10	9	17	4	
11	31	4	1	

Kern Trading and Oil Company.

(Sec. 25, T. 20 S., R. 14 E.)

25	20	36	0	Last ten days all water.
37	31	76	76	
39	19	43	30	

Kern Trading and Oil Company.

(Sec. 19, T. 20 S., R. 15 E.)

15	28	19	2	
18	31	17	7	
20	19	19	0.4	
22	0	0	0	Idle since October, 1914, account small production.
24	21	25	0.8	
25	29	46	1	
28	28	63	5	
30	9	22	7	July, 1916.
32	9	31	72	
36	31	202	50	
38	4	171	15	November, 1916.

Nevada Petroleum Company.

(Sec. 30, T. 20 S., R. 15 E.)

3	31	63	118	
4	31	11	1	
5	31	11	2	
6	25	11	124	
7	0	0	0	Idle since December, 1914. Water possibly not shut off.
8	31	12	0.2	
4a	13	43	67	
5a	15	36	56	November, 1916. Working on well in December. Set packer account of water.
6a	31	46	7	
7a	0	0	0	Working on well testing water shut off.
8a	31	55	228	
8b	31	64	8	

American Petroleum Company.

(Sec. 19, T. 20 S., R. 15 E.)

Well number	Days	Barrels oil	Barrels water	
1	31	19	168	
2	31	12	3	
3	31	9	8	
4	31	13	7	
5	31	51	131	
6	31	34	63	
7	31	47	28	
8	31	31	0.9	
11	0	0	0	Recemented September, 1916, account "top" water.
12	0	0	0	Shut down June, 1911, account small production.
13	25	24	72	
14	31	35	41	
15	31	108	38	
16	31	87	10	
17	25	27	17	

American Petroleum Company.

(Sec. 30, T. 20 S., R. 15 E.)

1 (N-30)	31	10	22	
2 (N-30)	0	0	0	Abandoned.
3 (N-30)	31	31	27	
4 (N-30)	0	0	0	Shut down.
5 (N-30)	31	19	1	
6 (N-30)	31	116	39	
7 (N-30)	31	28	214	
8 (N-30)	31	44	104	
9 (N-30)	13	5	431	November, 1916.
10 (N-30)	31	28	43	
11 (N-30)	31	18	284	
12 (N-30)	0	0	0	Abandoned.
18	31	6	132	
22	31	22	250	
23	0	0	0	Idle since October, 1915. (Bridge over oil sand account "top" water.)
24	0	0	0	Idle since August, 1915.

Creme Petroleum Company.

(Sec. 30, T. 20 S., R. 15 E.)

	0	0	0	Idle since 1913.
	0	0	0	Idle since 1913.

For the purpose of comparison the wells are segregated into three classes according to their average daily production of oil:

First: Under 20 bbls. per day.

Second: Between 20 and 40 bbls. per day.

Third: Over 40 bbls. per day.

This segregation is shown on an accompanying map.

For the purpose of comparison the wells are also segregated into three classes, according to the average daily production of water. The same figures are used for this classification as before mentioned

(under 20, 20 to 40, and over 40), and this segregation is shown on an accompanying map.

Study of the map upon which the wells are segregated according to the amounts of water produced shows the probable area within which the damage complained of is confined.

Such an area is shown on both of the accompanying maps, its limits, or boundary lines, being in general determined by the location of wells making less than 20 bbls. of water per day.

Wells situated within the area of damage total 23, and are shown in the following list, arranged in order according to the dates at which a marked increase of water occurred. These dates are determined from written reports furnished by the various companies, with the exception of the Creme Petroleum Company for their own wells. In all of the wells, unless otherwise noted, excessive amounts of water have continued or increased since the date given herewith.

Name of well	Number	Section	Township	Range	Date of marked water increase	Average daily production, Dec., 1916, barrels	
						Oil	Water
American Petroleum	5	19	20	15	Nov., 1910	51	131
American Petroleum	6	19	20	15	Jan., 1911	34	63
Creme Petroleum	2	30			July, 1911	*	*
American Petroleum	1	19	20	15	Sept., 1911	19	168
American Petroleum	12 (N-30)	30	20	15	Feb., 1912		
American Petroleum	8 (N-30)	30	20	15	April, 1912	44	104
American Petroleum	2 (N-30)	30	20	15	June, 1912		
American Petroleum	1 (N-30)	30	20	15	July, 1912	10	22
American Petroleum	4 (N-30)	30	20	15	July, 1912		
Creme Petroleum	1	30	20	15	July, 1912		
American Petroleum	6 (N-30)	30	20	15	Aug., 1912	116	39
American Petroleum	7 (N-30)	30	20	15	Sept., 1912	28	214
Nevada Petroleum	6	30	20	15	Nov., 1912	11	124
American Petroleum	18	30	20	15	Jan., 1913	6	132
American Petroleum	24	30	20	15	Jan., 1913		
Nevada Petroleum	7	30	20	15	April, 1913		
American Petroleum	9 (N-30)	30	20	15	June, 1913	5	431
Kern Trading & Oil	37	25	20	14	Aug., 1913	76	76
Kern Trading & Oil	39	25	20	14	Oct., 1913	43	30
Kern Trading & Oil	35	25	20	14	Oct., 1913		
American Petroleum	3 (N-30)	30	20	15	Mar., 1914	31	27
American Petroleum	11 (N-30)	30	20	15	Mar., 1914	18	284
American Petroleum	10 (N-30)	30	20	15	July, 1914	28	43
Totals						520	1 888

*Probably water afterwards eliminated.

Of these twenty-three (23) wells recent production figures are given herewith for fifteen (15), and from them there is a daily production of 520 bbls. of oil and 1888 bbls. of water (nearly four bbls. of water to one of oil).

In addition to the previously mentioned facts the investigation has covered the underground conditions as shown by the well logs. The large amount of data involved in this phase of the work can not be

readily summarized here, and in fact can probably be shown only by means of a model which the Supervisor proposes to immediately construct. It may be well, however, to note at this time that the investigation has thus far disclosed that the present condition of Creme Petroleum No. 1 is almost identical with that of American Petroleum Well No. 2 (N-30), Sec. 30, T. 20 S., R. 15 E.; American Petroleum Well No. 4 (N-30), Sec. 30, T. 20 S., R. 15 E.; American Petroleum Well No. 12 (N-30), Sec. 30, T. 20 S., R. 15 E.; Nevada Petroleum Well No. 7, Sec. 30, T. 20 S., R. 15 E.—in that all five wells are plugged above the oil sands. Of these five wells, two—Creme Petroleum No. 1 and American Petroleum No. 2 (N-30)—entered water below the oil sands; both wells were plugged in an attempt to shut off this water from the oil sands. It appears that said plugging in Creme Petroleum Well No. 1 was successful and so demonstrated. No evidence has been presented to the Supervisor proving that said plugging in American Petroleum No. 2 (N-30) was successful.

The foregoing statements of the investigation show that there is not yet enough evidence before the Supervisor to justify an order for extensive repair work on any individual well. The foregoing statements do show that further tests and investigations are justified with a view to more definitely locating the source or sources of water at present entering the oil sands and then repairing the well or wells causing the damage.

Now, therefore, pursuant to Sections 8 and 11 of Chapter 718, Statutes of 1915, it is hereby ordered that the following tests be made:

There are two kinds of comparatively inexpensive tests to be made on certain wells, namely, tests to determine depths at which fluid stands in each well, and tests to more frequently and accurately measure the amounts of oil and water produced by each well. The wells requiring these further tests are:

Kern Trading & Oil Co., Nos. 35, 37, 39, Sec. 25, T. 20 S., R. 14 E.
American Petroleum Co., Nos 1, 5, 6, Sec. 19, T. 20 S., R. 15 E.
American Petroleum Co., Nos. 1 (N-30), 3 (N-30), 6 (N-30), 7 (N-30), 8 (N-30), 9 (N-30), 10 (N-30), 11 (N-30), Sec. 30, T. 20 S., R. 15 E.
American Petroleum Co., Nos. 18, 24, Sec. 30, T. 20 S., R. 15 E.
Nevada Petroleum Co., No. 6, Sec. 30, T. 20 S., R. 15 E.

The test to determine the depth at which fluid stands is to be made by withdrawing the tubing from the well, and after ten hours from the time the tubing is removed, measuring to the surface of the fluid, measurement to be witnessed by the Supervisor or a representative designated by him for that purpose. This test must be made at each well within sixty days from date hereof.

The measurement of amounts of oil and of water produced to be made by running all fluid from the well into a tank of not less than fifty barrels capacity. The flow into the tank to continue for twenty-four (24) hours, unless the flow is sufficient to fill the tank in less than twenty-four (24) hours, when a shorter period of time is permissible. At the end of the prescribed period of time the flow into the tank to be stopped and the total fluid measured. Such free water as may have settled to the bottom of the tank to be drawn off and the remaining fluid again measured and sampled to determine the amount of water held in suspension, as shown by proper test with centrifuge.

The measurements of amounts of oil and of water must be made at each well at least once a week during the sixty days following the date of this order. A written statement covering all these tests to be filed with the Supervisor at the end of sixty days from date hereof.

Details of the manner of making these tests and submitting statements of the results thereof to be subject to the approval of the Supervisor or a representative designated by him for that purpose.

SUPPLEMENT TO ORDER No. 1.

June 2, 1917.

To Creme Petroleum Company.
Peter tum Suden, Secretary.
Merchants National Bank Bldg.,
San Francisco, California.
Mr. Wm. L. McGuire, Crocker Bldg., San Francisco.
Mrs. Clara Curry, Tulare, California.

Supplementing and continuing "Order Number One, by the State Oil and Gas Supervisor, R. P. McLaughlin, dated February 13, 1917, relative to Creme Petroleum Oil Co. well number One, Section 30, T. 20 S., R. 15 E., M. D. B. & M., in the Coalinga Oil Field of California."

The various tests and measurements previously specified in the order have been completed as follows:

The depth to the top of the fluid in the various wells has been determined as specified. The amounts of oil and water pumped from the various wells has been determined as specified.

The prompt cooperation of the various companies and the complete records furnished are worthy of special mention.

A model has been constructed under the direction of the Supervisor and is now at the office of the Supervisor at Coalinga. Samples of the water pumped from various wells have been collected and analyzed under direction of the Supervisor.

The depth of fluid in Creme Petroleum Well No. 1 has also been determined by the Supervisor.

Comparison of all these data indicate that the damage complained of as originating in Creme Petroleum Well No. 1 affects only a portion of the wells previously enumerated in the order. The wells within the zone probably affected by the condition of Creme Petroleum Well No. 1, are as follows, all in Section 30, T. 20 S., R. 15 E., M. D. B. & M.

American Petroleum No. 9 (N30).
American Petroleum No. 10 (N30).
American Petroleum No. 11 (N30).
American Petroleum No. 12 (N30).
American Petroleum No. 18.
American Petroleum No. 24.
Nevada Petroleum No. 6.
Nevada Petroleum No. 7.
Creme Petroleum No. 1.
Creme Petroleum No. 2.

The result of pumping tests, fluid level measurements and water analysis is as follows:

	Barrels oil per day	Barrels water per day	Depth of fluid level	Analysis of water
American Petroleum, No. 9 (N30)	5.0	497.0	1,507	Top.
American Petroleum, No. 10 (30)	46.6	17.4	2,130	No sample.
American Petroleum, No. 11 (30)	21.0	247.0	1,510	Top.
American Petroleum, No. 12 (30)				No sample, abandon.
American Petroleum, No. 18	5.3	315.0	1,378	Top.
American Petroleum, No. 24	67.0	124.0	1,232	Top.
Nevada Petroleum, No. 6	9.3	326.0	1,295	Top.
Nevada Petroleum, No. 7				No sample.
Creme Petroleum, No. 1			350	No sample, idle.

The highest fluid level is in Creme Well No. 1, the next highest fluid level is in the adjoining well, American Petroleum No. 24, and the fluid levels are lower as these wells are departed from in any direction. When American Well No. 24 was measured for fluid level no free water was found in the bottom of the well and the first pumping test produced almost no water, which indicated that it is not the source of the damaging water in surrounding wells.

Nevada Petroleum Well No. 7 is at present being repaired and has a plug between the oil sand and top water in such condition as to indicate that it is not flooding surrounding wells.

American Petroleum No. 11 (N30), while having a high fluid level, is separated from the other wells by a well having a low fluid level. The first showing of water in the well was gradual, indicating that it is not the source of the water. It may, in the future, require testing, but not until more probable sources of water have been eliminated.

The wells within the group herein mentioned showed marked increase of water in the following chronological order:

Creme Petroleum No. 1, July, 1912.
Nevada Petroleum No. 6, November, 1912.
American Petroleum No. 18, January, 1913.
American Petroleum No. 24, January, 1913.
Nevada Petroleum No. 7, April, 1913.
American Petroleum No. 9, June, 1913 (N30).
American Petroleum No. 11, March, 1914 (N30).
American Petroleum No. 10, July, 1914 (N30).

It appearing to the Supervisor that in his judgment certain repair work is necessary at Creme Petroleum Well No. 1 to protect the petroleum and gas deposits from damage by underground water;

Now, therefore, pursuant to Sections 8 and 11 of Chapter 718, Statutes of 1915, it is hereby ordered, that work be performed in accordance with either of the two methods herewith specified:

First: Redrill or open the well to a depth of 2425′, put in a shot between depths of 2415′ and 2425′, consisting of at least 75 lbs. and not more than 250 lbs. of 80% gelatin, again clean out well to a depth of 2425′ and if after inspection of work by the Supervisor and subsequent order from him to put in another shot of similar size and material at the same place; wash out hole by means of clear water, place cement plug between depths of 2425′ and 2415′: determine to the satisfaction of the Supervisor that said cement plug has properly set; put in additional cement in the hole sufficient to fill it up to a depth of about 2400′; leave sufficient casing in hole to act as a conductor from the ground surface to a depth of 2400′.

Second: Place a string of casing at a depth not greater than 2415′: cement said string of casing, and satisfy the Supervisor that casing prevents the passage of water to points below the bottom of casing.

Deputy Supervisor R. D. Bush is hereby authorized to inspect and approve all details of the forementioned work.

Analyses of Water From Wells Near Property of Creme Petroleum Company.
(Grains per Gallon Expressed as Sodium Salts.)

Company	Well number	Sec.	T.	R.	Total solids	Total carbonates	Total sulphates	Total chlorides
American Petroleum	1 (N-30)	30	20	15	478	172.8	Trace	272.0
	3 (N-30)	30	20	15	521	201.0	Trace	287.8
	8 (N-30)	30	20	15	478	178.5	Trace	277.0
	9 (N-30)	30	20	15	219	59.7	96.0	54.5
	10 (N-30)	30	20	15	338	153.7	36.8	114.0
	11 (N-30)	30	20	15	239	76.6	90.1	60.2
	18	30	20	15	218	44.9	110.6	53.8
	24	30	20	15	221	47.3	107.2	54.4
Nevada Petroleum	6	30	20	15	217	45.5	110.7	53.8
	8.1	30	20	15	243	70.1	79.5	87.0
	1	20	20	15	249	94.7	Trace	119.4
Kern Trading & Oil	37	25	20	14	478	160.0	Trace	278.5
	40	19	20	15	297	91.6	Trace	163.0

Complaint No. 2.

Arizona Petroleum Company vs. *Strong Oil Company*, Section 14, Township 20 South, Range 14 East, M. D. B. & M.

A written complaint was received March 8, 1917, from the Arizona Petroleum Company, stating their belief that water was coming from the Strong Oil Company Well No. 1 or No. 2 into their Well No. 2. The Strong Oil Company was unable to furnish information as to the condition of all their wells, and particularly Well No. 2, the condition of which was doubtful, but agreed to erect a derrick, which had blown down, and investigate conditions in this well. With this understanding, no formal order was issued by the State Supervisor. Work was commenced at once, and, after finding that top water was not shut off, the $7\frac{5}{8}$" casing was landed above the oil sand and is now ready for test.

The following cases were investigated upon receipt of informal complaints, or were initiated by this department in order to prevent a widespread flooding of water:

1. *Shell Company of California* vs. *Coalinga Midland Oil Company*, Section 10, Township 19 South, Range 15 East, M. D. B. & M.

On February 3, 1917, the Shell Company withdrew its offer to test out the Coalinga Midland well. On July 9, 1917, a proposal to plug and abandon the well was received from the Coalinga Midland Oil Company and was submitted by this department to the Shell Company for approval, but to date no reply has been received.

2. *Coalinga Homestake Oil Company* vs. *Caledonian Oil Company*, Section 26, Township 20 South, Range 14 East, M. D. B. & M.

On August 4, 1916, a complaint was received from the Coalinga Homestake Oil Company regarding Well No. 2 of the Caledonian Oil Company. The complaint was based on general water conditions on the Coalinga Homestake, with no definite proof as to its source. This department requested further particulars regarding recent work on Coalinga Homestake wells Nos. 3, 5 and 6, and on August 22, 1916, this was submitted. No definite information was at hand as to the condition of Caledonian Well No. 2, and an effort to obtain this from the owner was made, without success. On June 25, 1917, notice of setting a packer in the water string of Coalinga Homestake Well No. 5 was received, since it appeared that the well was making its own water to some extent. The well is now making some oil and apparently improving. In Well No. 6, tests were made of the water string, and at this time indicate that the water string is tight. Bottom water, which was once drilled into and plugged off, has possibly again broken in. However, it is probable that one or more of the Caledonian wells are flooding the oil sands.

3. Nevada Petroleum Well No. 1, Section 20, Township 20 South, Range 15 East, M. D. B. & M.

This well, as originally drilled, was deep enough stratigraphically to encounter bottom water, and produced water at first. While endeavoring to pull out the oil string, the derrick burned. After three months, some of the oil string was pulled out and a new one landed above the bottom sand, sidetracking 132′ of the old casing, which was not plugged, and which extends into the bottom sand. This sand was evidently plugged off in the old hole by sand and shale, as the well then produced clean oil for over five months, when, after a redrilling job, it produced 60% water, and has continued to pump a large quantity of water since then, which seriously affected the Southern Pacific Company's Well No. 40, Section 19. This matter had previously been under consideration by the Coalinga Water Arbitration Association, before the enactment of the present law, and the Nevada Petroleum Company had made unsuccessful attempts to shut off the water which was demonstrated, with very little doubt, to be bottom water, first by testing and eliminating the water string as a source, and, second, by chemical analysis. In May, 1917, the attention of the Nevada Petroleum Company was called to the fact that nothing was being done to remedy conditions, and immediate action was desired. Mr. Hardison, of the Nevada Petroleum Company, called a conference of five local operators to get their opinion of the best course of action to remedy the condition. The company then agreed to go ahead on the approved plan, which was also approved by this department.

PRODUCTION METHODS.

It is apparent that production practice of the Coalinga field has not reached as high an efficiency as is practicable. There are many properties that have made rapid strides in the right direction, but there is, in general, much to be done toward economical operation.

One of the properties that has made notable efforts to reduce production costs is the Inca Oil Company, located on the West Side in Section 24, T. 20 S., R. 14 E., M. D. B. & M. There are 34 wells producing on 160 acres, making an average of 4.7 acres per well, so that probably no further drilling is practicable. No new wells have been drilled since January, 1912. However, sand conditions are not yet entirely satisfactory, as the oil from about half of the wells has to be run into sumps for settlement.

The wells average about 475 barrels of clean oil per month, with a water content of 1.3%. The average proportional gravity is 13.5° Baumé, and the average depth of wells is 1060′, the shallowest being 824′ and the deepest 1290′. Many hundred feet of steam lines have

been abandoned, and every producing well on the property is pumped by jacks operated by two power plants. These powers are located near the center of the west half of the property. A separate cable runs to each well, making a total footage of about 28,140. Each power is operated by a 50-horsepower gas engine with magneto ignition. The average stroke of rods resulting from the motion of the lines is 18″, and the speed is 12 strokes per minute.

The wells are pulled and repaired by using a 35-horsepower traction engine. This is run to the well and connection made with 12′ lengths of metallic hose from traction boiler to steam engines at the well. The traction boiler is jacketed, but its low efficiency is more or less offset by the short delivery line. The portable outfit can carry enough water to run over a half day, after which it is refilled with distilled water, which has been condensed from steam used in the cleaning plant. The outfit requires about 30 barrels water and 4 barrels fuel oil per 10 hours when bailing or running tools. There has been ordered a second 35-horsepower traction engine to facilitate the work. Superintendent F. A. Wells estimates that the total consumption of fuel oil will then be about 300 barrels per month. There are ten men on the pay-roll, and costs per barrel, exclusive of amortization of capital and interest charges, run about 17 cents. This is equivalent to an average cost of operation per well per day of $2.60, excluding the same items as above mentioned. It is evident that these figures do not include an item which is chargeable to perhaps the majority of oil properties, namely, the cost of drilling to maintain production, but, as the production has not been maintained and the amount of oil produced has become less, the operating costs per barrel have raised.

Although the Inca Oil Company has used this system to great advantage, it could not be applied successfully to all properties. The Inca property is fairly hilly, but there have been provided good enough roads so that it is easy to move the traction engine to make short connection with the engine at any well.

If a property is too rough for this procedure, it might be advisable, other conditions warranting, to construct one or more good roads to accommodate the tractor and use longer temporary steam lines to the wells.

Such items as surface contour, amount and gravity of oil, amount of sand and mud, amount of water, depth of wells, and gas pressure enter into the problem. However, when a group of wells has become more or less settled, it is probable that this idea could be profitably adopted after making suitable modifications to such local conditions.

THE USE OF MUD FLUID IN ABANDONMENT.

The American Petroleum Company recently abandoned Well No. 8, Section 19, T. 20 S., R. 15 E., M. D. B. & M., protecting the oil sands from water by the use of mud fluid, as suggested by this department, which is anxious to give the method thorough tests. The work was inspected and approved by this department, but its entire effectiveness must be demonstrated in the future by the production of surrounding wells.

The accompanying graphic log shows the lower portion of the well and its condition just previous to the last redrilling job and abandonment, the latter being decided upon after mechanical troubles made it doubtful whether the 8¼″ casing could be successfully recemented to shut out top water. The 10″ was originally the water string, and the well produced for several years from the sands below it. Later, edge water appeared in the upper sands and was shut off with the 8¼″ casing at 1885′.

In preparation for the mudding and abandonment, 1864′ of 6⅝″ and 1826′ of 8¼″ casings were pulled out and the 8¼″ carried to 1980′ and the well cleaned out to 2004′. Mud fluid was obtained by mixing the surface formation, which was fairly good clay containing a small amount of fine grained sand, with water. A 40-horsepower boiler and Gumbo Buster pump was set some 900 feet from the well, where the mud was mixed by circulating the fluid through the pump and discharging it through a hose into the 50′x 75′ shallow reservoir made by plowing the ground and banking up the sides. The sand settled out to a great extent before the fluid reached the suction box at the pump. By adjusting the valves, the pump discharged

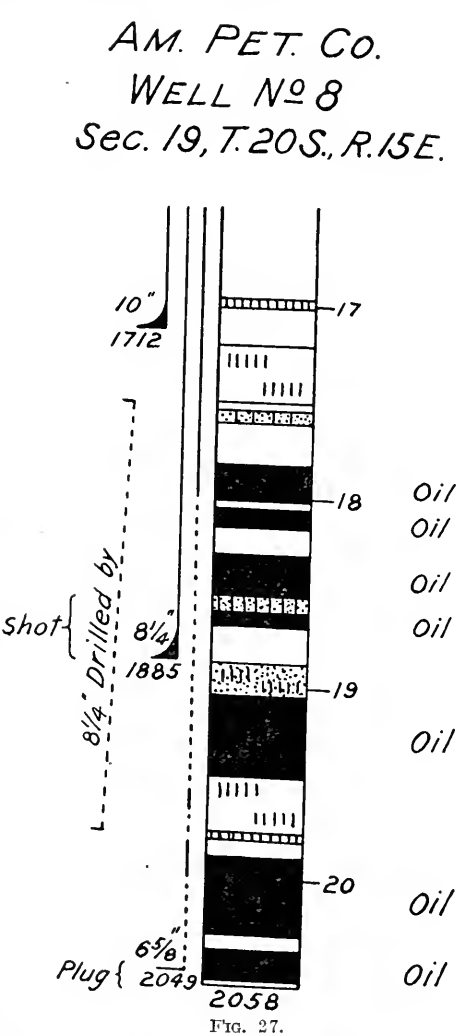


FIG. 27.

directly into the top of the 8¼″ casing at the well through a 2″ pipe line. The work at this plant was attended to by one man, with occasionally an extra helper, and the work at the well by two drilling crews of two men each.

No figures are available as to the yards of material pumped into the well, but some idea may be gained by an estimate of the time during which mud was being introduced into the well. The total time consumed in mudding, moving casing, plugging, cleaning out, etc., was forty-six days of twenty-four hours, and on every day except six mud was pumped into the well a portion of the time, occasionally with the

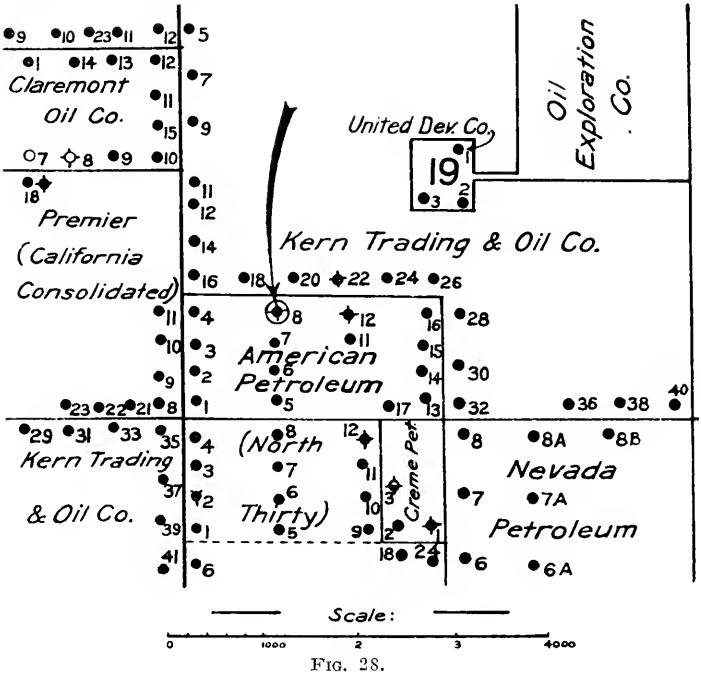


FIG. 28.

2″ valve wide open, but generally barely open, allowing just enough fluid to run in to keep the hole full, but not running over, between the 8¼″ and 10″ casings. In that manner the oil sands took all the mud put in, the quantity generally decreasing, until the hole stood full under the hydrostatic pressure only. A casing head was then put on with packing clamps between the 8¼″ and 10″ casings and more mud pumped in until the pressure was up to 200 lbs. and fell only 20 lbs. in one hour.

For the first sixteen days the 8¼″ casing was kept at 1927′ and the sand at that point mudded first, until it required pump pressure to force mud into the well. The casing was then lowered to 1976′ and the sands below 1990′ mudded in the same manner. Plugs of brick and

rope were then put in from 2004′ to 1949′. The casing was then pulled up to 1784′ and the upper sands mudded under pressure.

During the first portion of the work, the mud fluid was rather thin, so that the mud would be deposited in the sand voids for a considerable distance from the well, thus building up an artificial body of clay around the well, which should be impervious to water. As the sands became clogged with mud, the fluid was thickened and the final column of fluid standing in the well to the surface is of maximum density and its hydrostatic pressure greater than the water in any stratum of sand, and thus should confine all waters to the sands in which they occur.

Evidence that the mud fluid traveled away from the well when the fluid was thin is had from the fact that muddy water on the fifth day appeared in succession in the production of wells Nos. 7, 6 and 5, being more pronounced in the nearest one, No. 7, distant 332′, and least in No. 5, distant 1000′, and discontinued after the fluid was thickened and required pump pressure to force it into Well No. 8.

Sixty days after completion of the work, improvement in the production of the three above mentioned wells is shown by the following comparison:

	Average daily production at completion of work		Average daily production 60 days after completion of work	
	Barrels oil	Barrels water	Barrels oil	Barrels water
Well No. 7	16	418	19	219
Well No. 6	12	187	22	190
Well No. 5	12	373	19	249
Totals	40	978	60	658

PACKING HEAD FOR USE WITH MUD FLUID.

The recent extensive use of mud fluid in protecting oil sands from water and in forcing cement or mud into the formation under pressure have brought into use a number of appliances used to shut in the fluid and prevent circulation between the conductor casing and the movable casing which may be intended for an oil string, or a water string to shut off oil and water sands together. Among these appliances is a "packing head," perfected and used extensively by the fuel oil department of the Southern Pacific Company in this field. The accompanying drawing and photographs show its construction in detail and its general appearance.

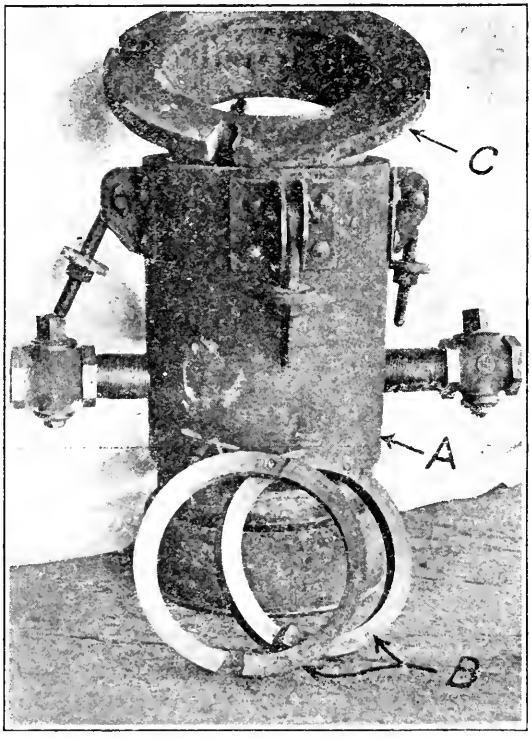


FIG. 29.

The packing head (A) shown is constructed to pack off between 8¾" and 6¼" casings and is screwed into the collar of the top joint of 8¾". The split packing rings (B) are put around the 6¼" casing and inside the head, the lower one resting on the shoulder and having about 6" of packing between them. The packing head sleeve (C) is put in, bearing on the top packing ring, and bolted down, packing the space between the casings tight enough to withstand a pressure of 1000 lbs. per square inch or more.

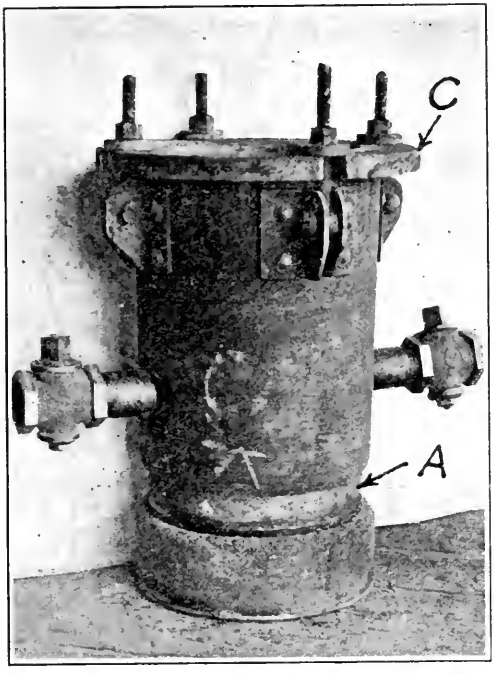
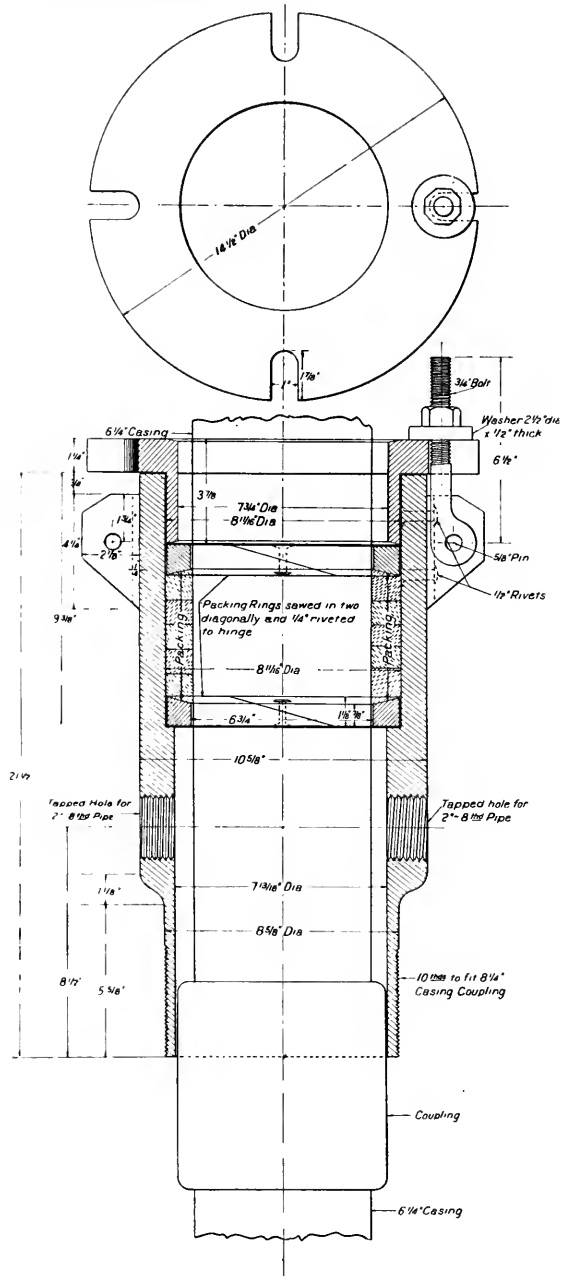


FIG. 30.

It is generally necessary to keep the inside string of casing loose by moving it frequently, and with the packing head this can be done without shutting the pump down or releasing the pressure, and the casing can be moved at any time a distance of 20′, between two couplings. If it becomes necessary to move the casing more than 20′, the pressure must be released and the packing head sleeve and rings removed, and the casing can then be raised or lowered the desired distance, the inside diameter of the head being sufficient to allow the passage of a coupling.

By means of the side outlets and valves, the pressure can be regulated or circulation maintained, as desired, and the whole operation can be conducted with a great saving of time and labor over the former method of using ordinary gas clamps and depending on the weight of the casing to make the packing tight. The packing head can also be used as a casing head for high pressure gas after the well is completed. A coupling on the oil string is either landed on the packing head sleeve, or the sleeve modified to take slips and hold the casing at any point on the top joint.

A packing head of the size shown in the drawing can be made at any machine shop at a cost of about $80, and other sizes approximately in proportion to the amount of steel used.



PACKING HEAD

PROVIDING FOR MOVEMENT OF 6¼" CASING WITHIN 8¼" CASING WHILE MAINTAINING PRESSURE BETWEEN THEM

(SOFT STEEL FINISHED ALL OVER)

SCALE OF INCHES

FIG. 31.

DECISIONS.

T. 12 S., R. 20 E., M. D. B. & M.

SECTION 17.

F. A. Rife & Co.

Well No. 1, drill new. AA-392.

A "wild cat" well near Clovis. It was recommended that the company notify this Department in case oil indications were found and that the company make a written report of test of water shut-off.

Exact information as to elevation and location was requested.

T. 12 S., R. 21 E., M. D. B. & M.

SECTION 18.

C. J. Heyler.

Well No. 1, commence drilling. AA-384.

A "wild cat" well near Clovis. It was recommended that the company notify this Department in case oil indications were found and that the company make a written report of test of water shut-off.

T. 18 S., R. 15 E., M. D. B. & M.

SECTION 27.

Standard Oil Co.

Well No. 1 (Domengine), abandon. AA-274.

When abandonment proposal was filed, well was plugged 4200–2600′. Company proposed to do additional plugging above 2600′. An investigation made by this Department showed that no oil or gas formations were encountered in this well. In view of this fact a decision was rendered stating that further plugging would not be required.

T. 19 S., R. 15 E., M. D. B. & M.

SECTION 2.

Imperial Oil Co.

Well No. 6, commence drilling. AA-257.

Approved proposed water shut-off at 2850′.

Well No. 6, shut-off. A-219.

Ten-inch cemented at 2773′. Water not shut off. Recommended cementing 8¼″ at about 2875′. However, company did not carry out this recommendation and cemented at 2810′, failing to shut off water.

Well No. 6, cement deeper. AA-515.

After shut-off with 8¼″ failed at 2810′, approved proposal to cement 8¼″ at 2817′.

Well No. 6, redrill. AA-564.

Shut-off at 2817′ failed. Approved proposal to cut out 2450′ of 8¼″ and cement 6¼″ at about 2840′.

Well No. 6, deepen. AA-597.

Approved proposal to cement 6¼″ at 2860′ after plugging oil sand found below.

Well No. 6, shut-off. A-338.

Shut-off tested. Hole not open into formation below cement bridge. Recommended drilling ahead into formation for another test.

Well No. 6, shut-off. A-340.

Well was cleaned out to a depth of 2875′ and test of water shut-off with 6¼″ at 2860′ was approved.

General Petroleum Corp.

Well No. 15, commence drilling. AA-594.

Proposed depth of water shut-off approved.

Well No. 15, shut-off. A-355.

Test of water shut-off satisfactory.

Well No. 32, commence drilling. AA-573.

Recommended water shut-off at 2227′, instead of 2270′ as proposed, in order to be above an oil sand open in neighboring wells.

Well No. 32, commence drilling. AA-575.

Corrected depth of water shut-off on account of new data on location of well.

Well No. 32, shut-off. A-334.

Test satisfactory.

Well No. 33, commence drilling. AA-645.

Approved proposed depth of water shut-off.

Section 10.

Shell Co. of California.

Well No. 7, shut-off. A-178.

Test satisfactory. Recommended deepening 20′ and make further test.

Well No. 7, abandon. AA-350.

Company proposed to clean out to 1265′ and rip, shoot, and plug with cement to 1150′. This Department recommended well be cleaned out to original bottom, 1435′, and plugged from this depth in the manner proposed.

Well No. 7, abandon. AA-358.

Confirming Report No. AA-350, pointing out that well was originally drilled to 1435′, leaving unplugged casing, and bottom was not at 1265′ as considered by the company.

Well No. 8, abandon. AA-406.

Proposed method of abandoning not entirely approved.

Recommended additional shooting and plugging.

Section 11.

Kern Trading and Oil Co.

Well No. 12, redrill. AA-235.

Approved proposal to replace collapsed oil string, using screen pipe on bottom.

Well No. 51, commence drilling. AA-650.

Recommended water shut-off at 1879′, instead of 1895′ as proposed.

Well No. 52, commence drilling. AA-651.

Recommended water shut-off at 2030′, instead of 2050′ as proposed.

Well No. 53, commence drilling. AA-652.

Recommended water shut-off at 2195′, instead of 2215′ as proposed.

Section 14.

Shell Co. of California.

Well No. 6, redrill to 1510′ and test. AA-368.

Recommended that company make casing test, drill out cement plug to 4′ below shoe, or to 1448′, and test well at this depth.

Well No. 6, redrill and plug. AA-395.

Company found small quantity of water after drilling 1′ below water string. Approved proposal to redrill to 1550′, plug to 1505′, and test by pumping.

Well No. 6, abandon. AA-415.

Previous tests did not determine the exact source of the water. Proposal to abandon was approved, recommending that sufficient casing be left in to act as a conductor to 1405′, so that well could be re-entered and additional work done, if necessary.

Well No. 6, perforate for water. AA-543.

Approved proposal to plug bottom of 12½″ casing and perforate for water.

Shell Co. of California.

Well No. 11, abandon. AA-524.

Proposed work of abandonment not approved until bottom water was successfully shut off.

Well No. 14, redrill. AA-623.

Proposal to plug for bottom water by simply ripping and plugging with cement inside of casing. Recommended shooting before plugging.

Well No. 14, redrill. AA-640.

Supplementing Report No. AA-623, approving ripping only before plugging, providing ripping was done so that hole could be cleared of iron and plugged in formation.

Well No. 16, deepen. AA-234.

Approved proposal to deepen.

Well No. 16, deepen. AA-314.

Approved proposal to plug bottom to determine possible source of water which entered well after deepening.

Well No. 16, plug bottom. AA-383.

Approved proposal to do additional plugging in lower portion of well.

Well No. 16, redrill. AA-449.

Approved proposal to insert 4½" screen liner to relieve sand trouble.

Well No. 17, deepen. AA-362.

Proposal to deepen approved.

Well No. 17, deepen. AA-413.

Approved proposal to deepen from 2215′ to about 2260′.

Well No. 19, deepen. AA-316.

Approved proposal to deepen from 2405′ to 2415′.

Well No. 19, deepen. AA-435.

Approved proposal to deepen from 2415′ to 2460′.

Well No. 19, redrill. AA-641.

Approved proposal to rip and plug in bottom. Recommended that sufficient ripping and cleaning out be done to entirely clear the hole of casing at the point of plugging.

Well No. 19, plug casing. AA-663.

Approved proposal to plug bottom of well with cement inside of casing without ripping or shooting. Called attention to the fact that water may come up outside of casing.

Well No. 21, commence drilling. AA-476.

Proposed depth of water shut-off approved.

Well No. 22, commence drilling. AA-475.

Proposed depth of water shut-off approved.

Well No. 23, commence drilling. AA-440.

Proposed depth of water shut-off approved.

Well No. 23, shut-off. A-328.

Approved test of water shut-off as satisfactory.

Well No. 23, redrill. AA-632.

Approved proposal to put in screen liner.

Well No. 24, commence drilling. AA-436.

Approved proposed depth of water shut-off.

Well No. 24, shut-off. A-280.

Test showed that sand had heaved into water string with 1640′ of oil and no free water. Recommended the company drill into the oil sands and make a production test.

Well No. 24, shut-off. A-329.

Production test showed water to be shut off.

Well No. 25, commence drilling. AA-471.

Proposed depth of water shut-off approved.

Well No. 25, shut-off. A-306.

Test of water shut-off satisfactory.

Shell Co. of California.

Well No. 25, redrill. AA-631.

Approved proposal to land screen liner.

Well No. 26, commence drilling. AA-529.

Recommended water shut-off 40′ deeper than proposed, pending report of depth to "red rock."

Well No. 26, shut-off. A-352.

Test of water shut-off satisfactory.

Well No. 27, commence drilling. AA-530.

Proposed depth of water shut-off approved.

Well No. 27, shut-off. A-330.

Test of water shut-off satisfactory.

Well No. 28, commence drilling. AA-552.

Proposed depth of water shut-off approved.

Well No. 29, commence drilling. AA-627.

Proposed depth of water shut-off approved.

SECTION 20.

Standard Oil Co.

Well No. 1, deepen. AA-343.

Approved proposal to deepen.

Well No. 1, shut off "bottom" water. AA-482.

Approved proposal to plug bottom in order to shut off water encountered in deepening.

Well No. 9 (Coalinga Oil Co.), redrill. AA-213.

Notice of intention to redrill was not received prior to commencement of work. Recommended that the company keep this Department informed of new developments during the drilling, particularly if well is to be deepened or water shut off.

Well No. 22, commence drilling. AA-341.

Approved proposed depth of water shut-off.

Well No. 23, commence drilling. AA-342.

Approved proposed depth of water shut-off.

SECTION 21.

Shell Co. of California.

Well No. 10, redrill. AA-493.

Proposal to pull 8½″ casing approved. Recommended the company plug lower portion of 10″ casing before removing upper portion of casing and that well be plugged in formation just below 12½″ before perforating this casing for test of upper sands.

SECTION 22.

Record Oil Co.

Well No. 12, shut-off. A-160.

Approved test of water shut-off with 10″ casing of 1674′.

Well No. 12, deepen. AA-244.

An investigation by this Department showed a serious water condition existed in this territory, and, in order to locate the source of the water and remedy this condition, if possible, approval was given to deepen and test each sand to locate probable intermediate water; to cement below water sand, using sufficient cement to protect upper formations. This proposal was called to the attention of neighboring operators before approval was given.

Well No. 12, redrill and deepen. AA-491.

Eight and one-quarter-inch cemented at 1860′ failed to shut off water. Rejected proposal to cement another string of 8¼″ at 1863′ before shooting 8¼″ sidetracked between 1775′ and 1860′.

Standard Oil Co.
Well No. 23, commence drilling. AA-553.
Proposed depth of water shut-off approved.
Well No. 23, shut-off. A-343.
Test of water shut-off satisfactory.

Good Luck Oil Co.
Well No. 6, abandon. AA-483.
Approved proposal to plug lower portion of well, specifying the depths at which plugging and testing should be done.
Well No. 6, abandon. AA-600.
After certain plugging had been done and tests made it was found advisable to supplement Report No. AA-483, stating that certain additional plugging required therein was not necessary.
Well No. 6, shut-off. A-346.
Test of water shut-off satisfactory.

Shell Co. of California.
Well No. 2, redrill (plug bottom). AA-461.
Approved proposal to redrill and plug.
Well No. 9, commence drilling. AA-470.
Approved proposed depth of water shut-off.
Well No. 10, redrill. AA-591.
Approved proposal to land liner.

Coalinga Peerless Co.
Well No. 21, shut-off. A-151.
Approved test of water shut-off.
Well No. 22, commence drilling. AA-295.
Approved proposed depth of water shut-off.
Well No. 22, shut-off. A-247.
Test of water shut-off satisfactory.

SECTION 26.

Shell Co. of California.
Well No. 2, redrill. AA-508.
Approved proposal to put in 4½" casing with packer.
Well No. 3, reperforate. AA-615.
Approved proposal to do additional perforating.
Well No. 13, shut-off. A-194.
Test of water shut-off approved.
Well No. 13, deepen. AA-278.
Approved proposal to deepen to brown shale.
Well No. 13, perforate. AA-612.
Approved proposal to do additional perforating of oil string.
Well No. 14, shut-off. A-150.
Test of water shut-off approved.
Well No. 14, deepen. AA-288.
Approved proposal to deepen to brown shale.
Well No. 14, plug bottom. AA-371.
Approved proposal to plug one sand at a time until water was shut off.
Well No. 14, shut-off. A-261.
After bottom had been plugged, a production test showed water entirely off.
Well No. 16, shut-off. A-208.
Test of water shut-off satisfactory.
Well No. 19, deepen and redrill. AA-451.
Approved proposal to redrill and deepen to brown shale.
Well (Metropolis) No. 21, redrill and deepen. AA-450.
Approved proposal to make pumping test to determine water condition, and recement 6¼" casing, if necessary. Recommended company clean well out to original depth, 3265', and make production test before deepening.

Shell Co. of California.

Well (Metropolis) No. 21, redrill and deepen. AA-450 Supp.

Recommended that if test of 6¼" was satisfactory the company deepen to 3310' as originally proposed.

Well (Metropolis) No. 21, make bailing test. AA-473.

Approved proposal to test by bailing, instead of pumping as originally proposed.

Well (Metropolis) No. 21, abandon. AA-633.

Proposal to abandon approved. Designated depths at which plugging should be done.

Well No. 22, commence drilling. AA-469.

Proposed depth of water shut-off approved.

Well No. 22, shut-off. A-310.

Test of water shut-off satisfactory.

Well No. 23, commence drilling. AA-502.

Proposed depth of water shut-off approved.

Well No. 23, shut-off. A-337.

Test of water shut-off satisfactory.

Well No. 24, commence drilling. AA-527.

Proposed depth of water shut-off approved.

Well No. 24, shut-off. A-350.

Test of water shut-off satisfactory.

Well No. 25, commence drilling. AA-599.

Proposed depth of water shut-off approved.

Well No. 26, commence drilling. AA-620.

Proposed depth of water shut-off approved.

Well No. 27, commence drilling. AA-634.

Proposed depth of water shut-off not approved. Recommended 35' higher.

SECTION 27.

Well No. 13, deepen. AA-481.

Approved proposal to deepen to brown shale.

Well No. 14, deepen. AA-480.

Approved proposal to deepen to brown shale.

Well No. 23, redrill and deepen. AA-233.

Approved proposal to redrill and deepen well about 40'.

Well No. 45, redrill. AA-487.

Approved proposal to remove upper portion of oil string.

Well No. 46, redrill. AA-356.

Approved proposal to perforate 6⅝" casing.

Well No. 47, redrill. AA-486.

Approved proposal to pull out 6⅝" casing which was hanging in well above top of liner.

Well No. 54, redrill. AA-313.

Approved proposal to redrill and deepen about 40' in order to make further test.

Well No. 54, shut-off. A-216.

Test was made with 6¼" casing landed at 1753', 53' below water string with one joint of screen pipe on bottom, solid pipe above. Test indicated that water was excluded from below 1733', but it was recommended that production test be made ninety days after completion. The production report after ninety days showed that the well made thirty barrels of oil and thirty-four barrels water per day. The source of this water has not been determined.

Well No. 54, redrill. AA-357.

Approved proposal to redrill and deepen to brown shale.

Well No. 55, shut-off. A-157.

Bailing test satisfactory. Production test recommended after sixty days.

Well No. 55, deepen. AA-248.

Approved proposal to deepen to brown shale.

Shell Co. of California.

Well No. 71, redrill. AA-365.

Proposal to cement 8¼" at 1650' was rejected as being below sands from which some neighboring wells are producing. Proposal to remove 10" casing was also rejected on account of permitting probable entrance of water into upper oil sands.

Well No. 71, redrill. AA-378.

The revised proposal to cement 8¼" between 1595' and 1620' was approved. Also approved proposal to fill space between 10" and 12½" with cement, leaving a 50' lap of 10" into 12½". The records do not show that cement was put between 10" and 12½" as proposed.

Well No. 71, shut-off. A-244. Test of water shut-off satisfactory.

Well No. 76, cut and pull oil string. AA-509.

Proposal to cut out portion of oil string approved.

Well No. 78, redrill. AA-287.

Approved proposal to plug below bottom of 10" and into 10" and perforate oil sands which were shut off.

Well No. 78, shut-off. A-253.

Production test showed that water was shut out of upper sands.

Well No. 78, cut out and pull oil string. AA-510.

Proposal to remove upper portions of oil string approved.

Well No. 79, commence drilling. AA-496.

Proposed depth of water shut-off approved.

Well No. 79, shut-off. A-322.

Test of water shut-off not approved. Three tests were made and a small quantity of water found to be entering the well. Recommended the well be deepened about 10" and the source of water determined.

Well No. 79, cement deeper. AA-642.

Approved proposal to mud off upper oil sands and cement below possible intermediate water.

Well No. 80, commence drilling. AA-307.

Proposed depth of water shut-off approved.

Well No. 80, shut-off. A-249.

Test of water shut-off satisfactory.

Well No. 81, commence drilling. AA-308.

Proposed depth of water shut-off approved.

Well No. 81, shut-off. A-262.

Test of water shut-off satisfactory.

Well No. 82, commence drilling. AA-398.

Proposed depth of water shut-off approved.

Well No. 82, shut-off. A-274.

Test of water shut-off satisfactory.

Well No. 83, commence drilling. AA-536.

Proposed depth of water shut-off approved.

Well No. 83, shut-off. A-324.

Test of water shut-off satisfactory.

Well No. 84, commence drilling. AA-558.

Proposed depth of water shut-off approved.

Well No. 84, shut-off. A-333.

Test showed a small leak. Recommended completion of well, after which a production test would be made.

Well No. 84, cement deeper. AA-639.

Approved proposal to mud off upper oil sands and cement below possible intermediate water.

Well No. 85, commence drilling. AA-593.

Proposed depth of water shut-off approved.

Well No. 86, commence drilling. AA-605.

Canceled and replaced by subsequent notice.

SECTION 28.

Standard Oil Company.

Well No. 46, deepen. AA-219.

A notice that well was deepened and 6⅝" liner ripped was received after work was done. Recommended that company submit proposals hereafter before work is commenced.

Well No. 78, abandon. AA-434.

Approved proposal to shoot and plug with cement the lower portion of the well.

Well No. 91, redrill. AA-394.

Approved proposal to shoot and plug in order to shut off "bottom water."

Well No. 97, shut-off at about 2730'. AA-258.

The proposal to cement 10" casing at about 2730' provided no oil sands were encountered above, was approved. It was recommended that certain information relative to plugging and shooting on the company's neighboring wells be filed.

Well No. 97, shut-off. A-207.

Test of water shut-off approved as satisfactory.

Well No. 105, commence drilling. AA-587.

Proposal to drill this well for the deep sands below the brown shale. The shut-off points above and below the upper oil sands approved. Recommended that this department be notified for tests of both cement jobs.

SECTION 29.

Shell Company of California.

Well No. 3, redrill. AA-372.

Approved proposal to redrill in order to locate water. Recommended that company plug up to 2425' as proposed, and, if found necessary, shoot and plug in the formation above this point.

Well No. 3, abandon. AA-511.

Proposal to abandon approved, recommending additional shooting and plugging.

Well No. 4, abandon. AA-512.

Proposal to abandon approved, after shooting and plugging, instead of ripping and plugging as proposed.

Well No. 6, test by pumping. AA-262.

Approved proposal to drill well into first sand below shut-off point and make production test.

Well No. 6, shut-off. A-173.

The well was given a bailing test, and it was recommended that a further test be made to determine, if possible, the source and amount of water entering the well.

Well No. 6, shut-off. A-186.

A production test showed that the well made 17% water. A proposal to deepen the well was approved, and it was recommended that a production test be made thirty days after completion.

Well No. 6, test for water. AA-329.

A notice was received from the company stating that well had been plugged in the bottom. The proposal to perforate the sands above the plug was approved, in order to locate, if possible, the source of the water.

Well No. 6, redrill. AA-474.

Approved proposal to drill out the upper 5' of the plug which had been placed in the bottom of the well.

Well No. 6, shut-off. A-272.

A production test showed that water was excluded from the formations between depths of 2693' and 2785'. There is no data at hand to show that oil sands recorded between depths of 2828' and 2850' have been protected from water.

Well No. 6, continue drilling. AA-559.

The company notified that the lower portion of the water string had been drilled off and proposed to complete redrilling. Proposal approved and recommended that pumping test be made after completion.

SECTION 31.

Associated Oil Co.
Aztec New No. 3, commence drilling. AA-556.
Proposed depth of water shut-off approved.
Well No. 21, commence drilling. AA-401.
Proposed depth of water shut-off approved.
Well No. 21 (Aztec), commence drilling. Supp. to AA-401.
Revised proposal to shut off water at a lower depth was approved.
Well No. 21 (Aztec), shut-off. A-307.
Test of water shut-off satisfactory.
Aztec No. 21, redrill. AA-630.
Approved proposal to plug off bottom water.
Aztec No. 22, commence drilling. AA-555.
Proposed depth of water shut-off approved.
Well No. 22, shut-off. A-345.
Test of water shut-off satisfactory.
Aztec No. 32 (Old No. 2), redrill. AA-478.
Approved proposal to pull out collapsed oil string and redrill the well.

Maine State Oil Co.
Well No. 8, redrill. AA-243.
Approved proposal to redrill on account of collapsed oil string.
Well No. 9, abandon. AA-403.
Approved proposal to remove oil string and plug in formation below and into water string and perforate water string for a water well.
Well No. 12, commence drilling. AA-429.
The proposed depth of water shut-off approved.
Well No. 12, shut-off. A-292.
Test of water shut-off satisfactory.
Well No. 13, commence drilling. AA-535.
Proposed depth of water shut-off approved.
Well No. 13, shut-off. A-351.
Test of water shut-off uncertain.

Commercial Petroleum Co.
Well No. 5, redrill. AA-407.
Approved proposal to redrill well on account of collapsed oil string.

Confidence Oil Co.
Well No. 5, redrill. AA-592.
Approved proposal to remove upper portion of oil string.

SECTION 32.

Pantheon Oil Co.
Pantheon No. 1, commence drilling. AA-638.
Proposed depth of water shut-off approved.
Pantheon No. 1, commence drilling. AA-648.
Proposal to shut off water 55′ deeper than originally proposed approved.

Associated Oil Co.
Pantheon No. 21, begin drilling. AA-517.
Recommended that company shut off water 35′ higher than proposed.

Pantheon Oil Co.
Well No. 21, shut-off. A-323.
Test of water shut-off satisfactory.
Pantheon No. 22, commence drilling. AA-667.
Recommended that company shut off water 13′ higher than proposed.
Pantheon No. 31, commence drilling. AA-669.
Proposed depth of water shut-off approved.

Pantheon Oil Co.
Pantheon No. 32, commence drilling. AA-668.
Recommended that company shut off water 27' higher than proposed.
Pantheon No. 33, commence drilling. AA-576.
Proposed depth of water shut-off approved.
Well No. 51 (old No. 3), redrill. AA-454.
This well had not penetrated the oil sand. Approved proposal to sidetrack lower portion of the former water string and cement the well at a lower depth.
Pantheon No. 51 (old No. 3), abandon. AA-519.
Approved proposal to abandon.
Well No. 51, commence drilling. AA-607.
Recommended company shut off water 24' higher than proposed.

Coalinga Empire Co.
Well No. 2, shut-off. A-195.
Test of water shut-off approved as satisfactory.

SECTION 33.

Kern Trading & Oil Co.
Well No. 39, abandon. AA-285.
Approval was given to plug and abandon the well as outlined in the notice, leaving conductor casing from surface to the top of the oil sand.
Well No. 40, redrill. AA-479.
Approved proposal to redrill well on account of collapsed oil string.
Well No. 40, redrill. AA-635.
Approved proposal to replace collapsed oil string.
Well No. 239, commence drilling. AA-430.
Proposed depth of water shut-off approved.

SECTION 34.

Shell Company of California.
Well No. 2, shut-off. A-177.
Test of water shut-off satisfactory.
Well No. 2, deepen. AA-291.
Proposal to deepen to brown shale approved.
Well No. 5, shut-off. A-179.
Test of water shut-off satisfactory.
Well No. 5, deepen. AA-292.
Approved proposal to deepen well to brown shale.
Well No. 7, redrill. AA-346.
Approved proposal to remove upper portion of oil string.
Well No. 8, redrill. AA-344.
Approved proposal to remove upper portion of oil string.
Well No. 8, redrill. AA-364.
Approved proposal to do additional perforating of oil string.
Well No. 8, redrill. AA-442.
Approved proposal to redrill on account of collapsed oil string.
Well No. 8, redrill. AA-548.
Approved proposal to put in liner.
Well No. 9, redrill. AA-340.
Approved proposal to remove upper portion of oil string.
Well No. 10, redrill. AA-339.
Approved proposal to remove upper portion of oil string.
Well No. 11, shut-off. A-172.
A bailing test reported by the company was approved, but, on account of sand heaving into the water string, a production test was recommended sixty days after completion.
Well No. 11, redrill. AA-268.
Approved proposal to redrill and deepen to brown shale.

Shell Co. of California.
Well No. 13, redrill. AA-348.
Approved proposal to do additional perforating and to remove upper portion of oil string.
Well No. 14, redrill. AA-337.
Approved proposal to remove upper portion of oil string.
Well No. 15, redrill. AA-338.
Approved proposal to remove upper portion of oil string.
Well No. 16, redrill. AA-336.
Approved proposal to remove upper portion of oil string.
Well No. 19, redrill. AA-345.
Approved proposal to do additional perforating of oil string.
Well No. 20, redrill. AA-335.
Approved proposal to remove upper portion of oil string.
Well No. 20, redrill. AA-363.
Approved proposal to do additional perforating of oil string.
Well No. 21, redrill. AA-347.
Approved proposal to do additional perforating of oil string and remove upper portion of same.
Well No. 22, redrill. AA-269.
Approved proposal to redrill on account of collapsed oil string.
Well No. 29, deepen. AA-232.
Approved proposal to deepen to brown shale.
Well No. 29, perforate. AA-613.
Approved proposal to do additional perforating of oil string.
Well No. 31, shut-off. A-167.
Test of water shut-off approved.
Well No. 32, commence drilling. AA-397.
Proposed depth of water shut-off approved.
Well No. 32, shut-off. A-264.
Test of water shut-off satisfactory.
Well No. 33, commence drilling. AA-497.
Proposed depth of water shut-off approved.
Well No. 33, shut-off. A-311.
Test of water shut-off satisfactory.
Well No. 34, commence drilling. AA-525.
Proposed depth of water shut-off approved.
Well No. 34, shut-off. A-326.
Test of water shut-off satisfactory.
Well No. 35, commence drilling. AA-589.
Recommended that company shut off water 20′ higher than proposed.
Well No. 36, commence drilling. AA-646.
Proposed depth of water shut-off approved.

SECTION 35.

Kern Trading & Oil Co.
Well No. 3, commence drilling. AA-421.
Proposed depth of water shut-off approved.
Well No. 3, shut-off. A-319.
Test of water shut-off satisfactory.
Well No. 13, abandon. AA-447.
The proposal to abandon the well was approved after certain tests had been made. The first test was to determine water condition of the well and additional tests after certain plugging had been done.
Well No. 22, shut-off. A-241.
Test of water shut-off approved as satisfactory.
Well No. 22, redrill. AA-443.
The notice stated that water string had accidentally been shot off. Approval was given to recement at the same depth as formerly.

Kern Trading & Oil Co.
Well No. 22, shut-off. A-291.
Test of water shut-off approved.
Well No. 22, redrill. AA-567.
Approved proposal to plug off bottom water.
Well No. 25, commence drilling. AA-459.
Proposed depth of water shut-off approved after receipt of supplementary notice.
Well No. 25, shut-off. A-347.
Test of water shut-off satisfactory.
Well No. 26, commence drilling. AA-460.
Proposed depth of water shut-off approved after receipt of supplementary notice.
Well No. 30, abandon. AA-419.
Proposed method of abandonment approved.
Well No. 33, commence drilling. AA-532.
Proposed depth of water shut-off approved.
Well No. 35, commence drilling. AA-531.
Recommended that company report depth to red rock for purpose of checking proposed depth of water shut-off.
Well No. 35, shut-off. A-354.
Test of water shut-off satisfactory.
Well No. 37, commence drilling. AA-664.
Notice received after well was cemented. The depth of water shut-off probably too deep.
Well No. 38, commence drilling. AA-665.
Proposed depth of water shut-off approved.
Well No. 41, commence drilling. AA-653.
Recommended that company shut off water 55′ above the point proposed.
Well No. 44, commence drilling. AA-654.
Recommended that company shut off water 28′ above the point proposed.
Well No. 45, commence drilling. AA-655.
Recommended that company shut off water 23′ above the point proposed.
Well No. 71, commence drilling. AA-656.
Recommended that the company shut off water 81′ above the point proposed.
Well No. 72, commence drilling. AA-657.
Recommended that the company shut off water 47′ above the point proposed.

SECTION 36.

Shell Company of California.
Well No. 1, deepen. AA-270.
Approved proposal to deepen about 35′.
Well No. 1, redrill. AA-448.
Approved proposal to remove a string of $4\frac{3}{4}$″ casing which was hanging in the well.
Well No. 2, shut-off. A-213.
Test of water shut-off approved.
Well No. 2, redrill. AA-464.
Approved proposal to plug bottom of well.
Well No. 2, plug bottom. AA-507.
Approved proposal to plug off bottom water.
Well No. 2, redrill. AA-547.
Approved proposal to do additional plugging in bottom.
Well No. 3, commence drilling. AA-411.
Proposed depth of water shut-off approved.
Well No. 3, shut-off. A-321.
Test of water shut-off satisfactory.
Well No. 3, plug casing. AA-647.
Approved proposal to plug in bottom to shut off water.

Standard Oil Co.

Well No. 1, shut-off. A-214.

Production test indicated that "top water" in this well had been successfully shut off.

Well No. 6, drill new well. AA-463.

Proposed depth of water shut-off approved.

Well No. 6, shut-off. A-356.

Test of water shut-off satisfactory.

T. 20 S., R. 14 E., M. D. B & M.

SECTION 1.

Zier Oil Co.

Well No. 3, redrill. AA-661.

Approved proposal to replace collapsed oil string.

Well No. 4, redrill and deepen. AA-598.

Approved proposal to redrill and deepen about 40′.

Well No. 10, redrill. AA-414.

Approved proposal to remove liner and carry oil string to original depth.

Well No. 12, redrill. AA-629.

Approved proposal to replace collapsed oil string.

Well No. 16, redrill and deepen. AA-376.

Approved proposal to pull oil string; cement 10″ at about 565′; deepen well with 8¼″, prospecting for lower oil sand.

Well No. 16, redrill and deepen. AA-456.

A proposal to recement at 614′, which is below an oil sand open in neighboring wells, was not approved. Recommended that company submit any evidence they may have that this sand carries water before approval to shut it off would be given.

Well No. 16, bridge hole for test of water shut-off. AA-466.

No evidence was submitted proving that top oil sand carried water, but the 8¼″ was cemented at 621′ and a test of water shut-off showed that water was entering the well. Approved proposal to put bridge under water string and again test.

Well No. 16, shut-off. A-284.

Test demonstrated that the 8¼″ cemented at 621′ prevented water from passing to lower levels of the well. There was no evidence to show that the upper oil sand which was shut off was protected from water.

Well No. 16, redrill. AA-550.

Bottom water was encountered and the well plugged before filing notice. The location of plug and manner of plugging was approved and the company's attention called to the violation of the law regarding filing of notices before the work.

Well No. 17, redrill and deepen. AA-453.

Approved proposal to redrill and deepen this well.

Well No. 18, deepen. AA-586.

Rejected proposal to deepen from 461′ to about 700′. Recommended drilling not deeper than 580′ to avoid bottom water.

Penn Coalinga Petroleum Co.

Well No. 10, shut-off. A-222.

Test of water shut-off was satisfactory. Proposal to perforate oil string and make production test was approved.

SECTION 12.

Associated Oil Co.

Shawmut New No. 1, begin drilling. AA-516.

The proposal to shut off the "tar sand," open in some neighboring wells and non-productive, by using 100 sacks of cement was approved. The depth of water shut-off for this purpose was estimated to be 24′ deeper than proposed.

Well No. 1, shut-off. A-320.

Test of water shut-off satisfactory.

Associated Oil Co.
Shawmut New No. 2, commence drilling. AA-581.
Proposed depth of water shut-off approved.
Well No. 2, shut-off. A-348.
Test of water shut-off satisfactory.
Shawmut No. 3 (new number), commence drilling. AA-608.
Proposed depth of water shut-off approved.
Shawmut No. 4 (new number), commence drilling. AA-609.
Recommended depth of water shut-off 32′ higher than proposed.
Shawmut New No. 5, commence drilling. AA-582.
Recommended depth of water shut-off 106′ higher than proposed, to be the same relatively as neighboring wells.
Shawmut No. 21, commence drilling. AA-565.
Proposed depth of water shut-off approved.
Well No. 21, shut-off. A-336.
Test of water shut-off satisfactory.
Shawmut No. 24 (new number), No. 2 (old number), deepen. AA-583.
Approved proposal to deepen.
Shawmut No. 27 (old No. 4), deepen. AA-584.
Approved proposal to deepen.
Shawmut No. 31 (new number), No. 7 (old number), deepen. AA-585.
Approved proposal to deepen.
Shawmut No. 34, deepen. AA-588.
Approved proposal to deepen.
Well No. 41 (old No. 6), deepen. AA-462.
Approved proposal to deepen.
Shawmut No. 41, redrill. AA-551.
Approved proposal to pull back oil string and fill up lower oil sand.
Well No. 42 (old No. 8), deepen. AA-422.
Approved proposal to deepen.
Shawmut No. 44 (old No. 1), redrill. AA-505.
Approved proposal to redrill and lower oil string.

Homestead Development Co.
Well No. B-3, redrill. AA-468.
Approved proposal to remove oil string as low as possible and produce from open hole.
Well No. B4, redrill. AA-577.
Approved proposal to remove oil string or do additional perforating.
Well No. B-8, redrill. AA-324.
Approved proposal to replace liner with new perforated pipe.
Well No. B-9, begin drilling. AA-501.
'Proposed depth of water shut-off approved with understanding that "tar sand" would be protected with sufficient cement, as agreed to by Associated Oil Co.
Well No. B-9, shut-off. A-332.
Test of water shut-off satisfactory.
Well No. B-10, commence drilling. AA-616.
Proposed depth of water shut-off approved.
Well No. C-1, redrill. AA-562.
Approved proposal to pull or move oil string.
Well No. C-3, redrill. AA-211.
Approved proposal to replace old liner.
Well No. C-4, redrill. AA-438.
Approved proposal to replace collapsed oil string or insert liner.
Well No. C-5, reperforate. AA-566.
Approved proposal to reperforate from about 777′ to 700′.

Coalinga Star Oil Co.
Well No. 1, redrill. AA-389.
Approved proposal to carry oil string to old bottom, sidetracking liner.

Coalinga Star Oil Co.

Well No. 2, redrill. AA-570.

Approved proposal to pull 4½" casing and redrill with 6¼" oil string to old bottom.

Well No. 2, redrill. AA-606.

Approved proposal to set packer in water string. Recommended that company file notices before commencing work.

Well No. 8, redrill. AA-571.

Approved proposal to cut out 4½" casing and carry 6¼" oil string to old bottom.

Well No. 9, deepen. AA-637.

Approved proposal to deepen.

Well No. 10, redrill. AA-572.

Approved proposal to remove liner and carry oil string to bottom.

Well No. 11, redrill. AA-374.

Approved proposal to replace collapsed oil string. Attention of the company was directed to the fact that necessary records pertaining to this property had not been filed with this department.

Well No. 11, redrill. AA-452.

Attention of the company was directed to the fact that water was present in the well after redrilling. Approved proposal to pull oil string and plug below water string in order to pump cement behind same.

Pilot Oil Co.

Well No. 5, redrill. AA-671.

Approved proposal to put in new oil string.

Well No. 7, commence drilling. AA-424.

Proposed depth of water shut-off approved, making formation shut-off.

Well No. 7, shut-off. A-283.

Test of water shut-off satisfactory.

Well No. 7, deepen. AA-506.

Formation shut-off failed. Approved proposal to cement same string 16' deeper.

Well No. 7, shut-off. A-298.

Test of water shut-off satisfactory.

Spinks Crude Oil Co.

Well No. 1-E, redrill. AA-542.

Approved proposal to carry oil string to bottom, replacing liner.

Well No. 8, commence drilling. AA-622.

Proposed depth of water shut-off approved.

Seneca Oil Company.

Well No. 6, abandon. AA-610.

Approved proposal to abandon after certain plugging and testing. If the water present was found to be "bottom water" additional work would then be recommended.

Well No. 7, commence drilling. AA-209.

Proposed depth of water shut-off approved.

Well No. 7, shut-off. A-248.

Test of water shut-off satisfactory.

Ward Oil Co.

Well No. 3, redrill. AA-388.

Approved proposal to replace collapsed oil string.

SECTION 13.

Kern Trading & Oil Co.

Well No. 10, shut-off. A-236.

Production test showed that water had been shut off with packer.

Well No. 14, redrill. AA-408.

Approved proposal to set packer in water string.

Well No. 31, redrill. AA-225.

Approved proposal to replace oil string and land screen liner.

Union Oil Company of California.

Well No. 8, redrill. AA-312.

Approved proposal to set packer in water string.

Well No. 8, shut-off. A-231.

Production test showed an excessive amount of water. Recommended another test after 90 days.

Well No. 8, shut-off. A-267.

A production test indicated that water had been shut off with packer.

Well No. 9, redrill. AA-250.

Approved proposal to reset packer.

Well No. 9, redrill. AA-283.

Approved proposal to pull packer and test oil string for leak.

Well No. 9, shut-off. A-232.

A production test showed an excessive amount of water. Recommended another test after 90 days.

Well No. 9, shut-off. A-268.

Production test indicated water not shut off. Recommended pulling packer for examination and testing oil string.

Well No. 14, shut-off. A-233.

A production test showed excessive water. Recommended testing packer and oil string with dye.

Well No. 14, shut-off. A-269.

Production test showed practically no improvement. Again recommended testing packer and oil string with dye.

Well No. 16, redrill. AA-296.

Approved proposal to pull packer and repair leak in oil string.

Well No. 16, redrill. AA-355.

Approved proposal to pull packer and repair leak in oil string.

Well No. 16, shut-off. A-234.

Production test showed excessive water. Recommended further pumping.

Well No. 16, shut-off. A-270.

Production test showed improvement in water content. Recommended further pumping.

SECTION 23.

St. Paul Consolidated Oil Co.

Well No. 6, shut-off. A-182.

Test of water string satisfactory. Recommended drilling to about 700′ and testing before further deepening.

SECTION 24.

Inca Oil Co.

Well No. 7, redrill. AA-311.

Approved proposal to continue redrilling.

Well No. 33, shut-off. A-210.

Test of water string satisfactory.

Well No. 33, shut-off. A-215.

Test showed well not making top water. Recommended plugging in bottom.

Salvia Oil Co.

Well No. 2, report on work done. AA-239.

The water string was accidentally shot off, letting water into well. Well was bridged in water string below point of shooting. Bridge consisted of brick, adobe, and iron slivers, which may not have excluded water from oil sands. Recommended that well be cleaned out to top of the bridge and plugged with cement for at least 10′.

Well No. 6, shut-off. A-225.

Production test showed excessive water. Recommended further pumping.

Salvia Oil Co.

Well No. 9, shut-off. A-166.

Production test showed all water. Recommended further pumping.

Well No. 9, shut-off. A-226.

Production test showed slight improvement. Recommended further pumping.

Well No. 9, discontinue pumping. AA-444.

Approved proposal to discontinue pumping due to condition of Claremont wells Nos. 1 and 2. Recommended fluid level test.

Well No. 9, shut-off. A-286.

Test showed fluid had gone down 62′ in 30 days. Recommended further pumping.

Well No. 13, shut-off. A-227.

Well was not kept pumping, as previously recommended. A fluid level test was recommended.

Well No. 14, shut-off. A-228.

Production test showed excessive water. Recommended further pumping.

Well No. 14, shut-off. A-282.

Test to determine depth to top of fluid. Recommended further pumping.

Premier Oil Co.

Well No. 1, redrill. AA-528.

Approved proposal to proceed with redrilling, as previously recommended. This work was held up on account of tests being made on neighboring wells.

Well No. 1, shut-off. A-335.

Test of water shut-off satisfactory.

Traders Oil Co.

Well No. 3, redrill. AA-574.

Approved proposal to set packer in water string.

Well No. 3, shut-off. A-341.

Production test indicated that packer shut out water.

Well No. 16, commence drilling. AA-498.

Proposed depth of water shut-off approved.

Well No. 16, shut-off. A-301.

Test of water shut-off approved.

Well No. 17, drill new well. AA-458.

Proposed depth of water shut-off approved.

Well No. 17, shut-off. A-271.

Test of water shut-off satisfactory.

Well No. 18, shut-off. A-250.

Test of water shut-off satisfactory.

Well No. 19, commence drilling. AA-369.

Proposed depth of water shut-off approved.

Well No. 19, shut-off. A-245.

Test of water shut-off satisfactory.

Well No. 25, redrill. AA-281.

Notice stated that packer had been set and work was completed. Recommended that department be notified for test of water shut-off.

Well No. 25 shut-off. A-223

Production test showed excessive water. Recommended further pumping.

Well No. 29, redrill. AA-245.

Approved proposal to put in new oil string.

Well No. 37, commence drilling. AA-596.

Approved proposed depth of water shut-off.

Well No. 37, shut-off. A-342.

Test of water shut-off satisfactory.

Well No. 38, commence drilling. AA-523.

Approved proposed depth of water shut-off.

Well No. 38, shut-off. A-325.

Test of water shut-off satisfactory.

Traders Oil Co.

Well No. 41, commence drilling. AA-418.

Proposed depth of water shut-off approved. Recommended that cement be used in making this shut-off. After considerable correspondence and discussion, in which this department advocated the use of cement in shutting off water at this well, approval was finally given to make a formation shut-off.

Well No. 41, shut-off. A-278.

Test of water shut-off satisfactory. Well was reported to have stood 16 hours. $2\frac{1}{2}'$ of fluid was found at the time of test.

Well No. 41, redrill. AA-494.

Eight days after test, the company reported that a casing leak developed, and approval was given to try another formation shut-off with the same casing. However, cement was again advised.

Well No. 41, deepen. AA-513.

Approved proposal to cement $8\frac{1}{4}''$ below the 10", leaving the 10" undisturbed.

Well No. 41, shut-off. A-349.

Test of $8\frac{1}{4}''$, which was cemented, showed that water was completely shut off.

Claremont Oil Co.

Well No. 1, shut-off. A-165.

Packer in water string. Production test showed all water. Recommended further pumping.

Well No. 1, shut-off. A-229.

Production test showed no improvement. Recommended fluid-level test after 30 days.

Well No. 1, shut-off. A-258.

Fluid-level test indicated well probably making its own water. Recommended examination of packer and that company repair well.

Well No. 2, redrill. AA-217.

Approved proposal to set packer in water string.

Well No. 2, shut-off. A-230.

Production test showed all water. Recommended fluid-level test.

Well No. 2, shut-off. A-257.

Fluid-level test indicated that well probably was making its own water. Recommended examination of packer and that company repair well.

Well No. 4, redrill. AA-218.

Approved proposal to test effectiveness of bridge over oil sands by setting packer in water string and bailing out water.

Well No. 4, shut-off. A-193.

Test of bridge above oil sands satisfactory.

Well No. 7, commence drilling. AA-546.

Proposed depth of water shut-off approved.

Well No. 7, shut-off. A-344.

Test of water shut-off approved as satisfactory.

Well No. 8, commence drilling. AA-455.

Recommended point of water shut-off 25' higher than proposed.

Well No. 8, shut-off. A-315.

Test of water shut-off satisfactory.

Well No. 8, alter casing. AA-658.

Approved proposal to shut off water by setting packer in water string. It was called to the company's attention that the well was drilled through the "green shale" and may have bottom water.

Well No. 8, plug bottom of. AA-662.

Approved proposal to plug bottom to shut off water.

Well No. 11, redrill. AA-578.

Approved proposal to set packer in water string.

Well No. 20, commence drilling. AA-644.

Proposed depth of water shut-off approved.

SECTION 25.

Kern Trading & Oil Co.

Well No. 9, abandon. AA-489.

Approved proposal to abandon, specifying depths of shooting and plugging.

Well No. 10, abandon. AA-490.

Approved proposal to abandon, specifying depths of shooting and plugging.

Well No. 11, abandon. AA-488.

Approved proposal to abandon, specifying depths of shooting and plugging.

Well No. 22, redrill. AA-409.

Approved proposal to set packer in water string.

Well No. 35, fluid level. A-305.

Test to determine depth to top of fluid.

Well No. 35, redrill. AA-568.

It appearing to the State Supervisor that water had broken into this well and was probably coming through the water string and was damaging the producing oil sand, as shown by the production of a neighboring well, a formal order was issued to the company to repair the well by one of three specified methods. The company's proposal to set packer in the water string was approved.

Well No. 37, fluid level. A-308.

Test to determine depth to top of fluid.

Well No. 39, fluid level. A-295.

Test to determine depth to top of fluid.

Well No. 54, shut-off. A-357.

A production test showed excessive water. Further pumping was recommended.

SECTION 26.

Coalinga Homestake Oil Co.

Well No. 2-A, commence drilling. AA-273.

The company's proposal to shut off above and below the usual producing sands and prospect for a deeper sand was approved. The proposed depths of shut-off were approved.

Well No. 2-A, shut-off. A-251.

Test of water string showed no water below the shoe. This was cemented 80′ lower than proposed and approved, and formations open in neighboring wells were shut off.

Well No. 2-A, cement at about 754′. AA-420.

Approved proposal to cement below oil sands and above water at 754′. Recommended that if productive sand was not found deeper, that tests be made to show that upper sands are protected from water.

Well No. 2-A, shut-off. A-254.

Test to determine location of bottom water before cementing above it. Test satisfactory.

Well No. 2-A, shut-off. A-300.

Test showed some water entering well with 8¼″ cemented at 1625′, source undetermined. Later tests showed water was from a sand below 1635′. Recommended company file information previously requested.

Ozark Oil Co.

Well No. 2, redrill. AA-500.

Approved proposal to replace collapsed oil string.

Well No. 5, redrill. AA-282.

Approved proposal to remove oil string, bridge, and test for both top and bottom water.

Well No. 5, redrill. AA-404.

Approved proposal to bridge and test water string.

Well No. 6, redrill. AA-465.

Approved proposal to pull oil string and test for top and bottom water.

Ozark Oil Co.
Well No. 6, shut-off. A-281.
Test indicated that bottom water was shut off.
Well No. 6, abandon. AA-504.
Approved proposal to abandon.

Augustine and Butz.
Well No. 5, alter casing. AA-660.
Approved proposal to set packer in water string.
Well No. 6, redrill. AA-601.
Approved proposal to bridge and test water string.

Netherlands Oil Co.
Well No. 3, shut-off. A-239.
A production test showed excessive water. Recommended further pumping and that company file logs and other data in order to determine the probable source of this water.

SECTION 36.

Associated Oil Co.
Well No. 8-D, shut-off. A-358.
A production test indicated that water is shut off.
Well No. 9-D, shut-off. A-220.
A production test showed considerable improvement in water content.
Well No. 9-D, shut-off. A-303.
A production test indicated water is shut off.

T. 20 S., R. 15 E., M. D. B & M.

SECTION 1.

Kern Trading & Oil Co.
Well No. 3, commence drilling. AA-290.
Proposed depth of water shut-off approved after receipt of revised notice.
Well No. 3, shut-off. A-218.
Test of water shut-off satisfactory.
Well No. 4, commence drilling. AA-427.
Proposed depth of water shut-off approved.
Well No. 5, commence drilling. AA-289.
Proposed depth of water shut-off approved, after receipt of revised notice.
Well No. 5, shut-off. A-240.
Test of water shut-off approved.
Well No. 16, commence drilling. AA-533.
Recommended company report depth of red rock in order to check proposed depth of water shut-off.
Well No. 46, shut-off. A-163.
A small amount of water came into well while standing for test, which was probably returned drilling water. Well was passed for further drilling and recommended that a production test be made after completion.
Well No. 47, recement. AA-349.
A water sand was encountered under the first water string and proposal to cement deeper was approved.
Well No. 47, redrill. AA-446.
8¼" casing, which was cemented at a depth of 3867', failed to shut off water. Approved proposal to recement 8¼" casing at a depth of 3870'.
Well No. 47, shut-off. A-309.
Test of water shut-off satisfactory.
Well No. 47, redrill. AA-628.
Approved proposal to mud up under pressure and cement under pressure below first oil sand on account of unsuitability of formation and condition of hole above.
Well No. 138, commence drilling. AA-428.
Proposed depth of water shut-off approved.

SECTION 2.

Shell Oil Company of California.

Well No. 3, perforate 6⅝" casing. AA-386.

Proposal to do additional perforating of the oil string approved.

Well No. 3, redrill. AA-540.

Approved proposal to remove upper portion of oil string.

Well No. 10, shut-off. A-221.

Production test indicated that "bottom water" had been successfully shut off. Test approved.

Well No. 19, test for water. AA-328.

Attention of the company was directed to the fact that proposal to rip 4½" casing and plug at a certain depth was filed after such work had been done. Recommended that the company make further tests at the well and before doing additional work.

Well No. 19, shut-off. A-217.

Test indicated that water from below a depth of 3312' had been prevented from passing into formations above this point and that 6¼" casing shut off "top water."

Well No. 19, abandon. AA-360.

Proposal to abandon was approved. It was recommended that 8¼" casing be left in place as a conductor in case it was necessary to do additional work in the future.

Well No. 25, redrill. AA-259.

Approved proposal to redrill well in order to increase production and relieve sand trouble.

Well No. 28, deepen. AA-326.

Approved proposal to deepen.

Well No. 31, shut-off. A-158.

Test of water shut-off satisfactory.

Well No. 32, shut-off. A-211.

Test of water shut-off satisfactory.

Well No. 32, perforate. AA-614.

Approved proposal to do additional perforating of oil string.

Well No. 33, commence drilling. AA-246.

Approved proposed depth for shutting off the water.

Well No. 33, shut-off. A-263.

Test of water shut-off satisfactory.

Well No. 33, redrill. AA-626.

Approved proposal to put in liner.

Well No. 34, commence drilling. AA-247.

Approved proposed depth for water shut-off.

Well No. 34, shut-off. A-259.

Test of water shut-off satisfactory.

Well No. 35, commence drilling. AA-366.

Proposed depth of water shut-off approved.

Well No. 35, shut-off. A-297.

Test of water shut-off satisfactory.

Well No. 36, commence drilling. AA-367.

Approved proposed depth for water shut-off.

Well No. 36, shut-off. A-327.

Test of water shut-off satisfactory.

Well No. 37, commence drilling. AA-410.

Proposed depth of water shut-off approved.

Well No. 38, commence drilling. AA-526.

Proposed depth of water shut-off approved.

SECTION 3.

Kern Trading & Oil Co.

Well No. 26, commence drilling. AA-382.

Company proposed to shut water off at 3150'. This department estimated the top of oil sand to be 3189' and recommended that water be shut off at some point above this depth.

Well No. 26, shut-off. A-275.

Test of water shut-off satisfactory.

SECTION 4.

Coalinga-Monterey Oil Co.

Well No. 1, abandon. AA-396.

Approved proposal to remove all casing available. Oil-bearing formations were not encountered in this well. No plugging was required.

Union Oil Company of California.

Well No. 4, La Vista, abandon. AA-381.

Proposal to abandon was rejected and recommendation made that certain sands be protected by plugging before available casing was pulled.

Well No. 4, abandon. AA-621.

Approved proposal to remove upper portion of 8¼" and 10" casings with the understanding that well would be left in such shape that plugging could be done in the future, if found necessary.

SECTION 6.

General Petroleum Corporation.

Well No. 1, shut-off. A-149.

Test showed that water was not shut off. Approved proposal from company to shut off water at a lower depth.

Well No. 1, shut-off. A-243.

Test of water shut-off approved.

Well No. 1, redrill. AA-399.

Proposal to deepen well was approved.

Well No. 1, redrill. AA-499.

The proposal to remove oil string and do additional perforating was approved.

Well No. 4, redrill. AA-557.

Approved proposal to move oil string and do additional perforating.

Well No. 8, redrill. AA-405.

Proposal to test the 8¼" water string and redrill was approved.

Well No. 8, redrill. AA-569.

Approved proposal to put in new oil string.

Well No. 12, redrill. AA-400.

Approved proposal to redrill well in order to obtain production from the "light oil sand" and if this result was not satisfactory, to redrill to original depth in order to produce from the "heavy sand."

Well No. 12, abandon. AA-522.

Approved proposal to abandon.

Well No. 22, redrill. AA-320.

Approved proposal to raise screen pipe in order to produce from open hole.

Well No. 27, redrill. AA-539.

Approved proposal to put in new oil string.

Well No. 34, shut-off. A-197.

Test of water shut-off satisfactory.

Well No. 35, shut-off. A-176.

Test of water shut-off satisfactory.

Well No. 36, redrill. AA-303.

Approved proposal to perforate oil string in order to produce from "light oil sand."

Well No. 37, deepen. AA-236.

Approved proposal to deepen.

General Petroleum Corporation.

Well No. 37, redrill. AA-319.

Approved proposal to put bridge in bottom of well and heaving plug in 8¼" casing in order to shut off heavy oil and water which possibly came from the bottom.

Well No. 37, test for water. AA-351.

Approved proposal to remove oil string and bridge below water string in order to test same.

Well 37, redrill. AA-361.

The company proposed to shut off water by tamping around 6¼" down to 1340' with the 8¼" casing. It was recommended that the company try the tamping process in an endeavor to shut water off in this well.

Well No. 37, shut-off. A-260.

This test demonstrated that formations between depths of 1286' and 1330' were protected from water. There is no evidence at this time to show that the oil-bearing formations between 1152' and 1286' are protected from water.

American Petroleum Company.

Well No. 13, deepen. AA-222.

Proposal was to deepen, mud up, and cement off a sand which was expected to be encountered. This sand contained "edge-water" in the vicinity of this well. Recommended that the company enter this sand and determine its contents. In case water was found in it, that they cement a string of casing in the shale above the water sand, in order to protect the upper oil sands before deepening.

Well No. 14, deepen. AA-221.

The proposal was to deepen, mud up, and cement off a sand which carried "edge-water" in an adjoining well. Recommended that the company test the "edge sand" in order to determine its contents, and, in case water was found, that they cement a string of casing in the shale above the water sand in order to protect the upper oil sands. In case the "edge sand" was found to contain oil at this well, the proposed method by the company would be satisfactory, as long as they could prove that the upper oil sands were fully protected.

Well No. 15, deepen. AA-223.

The proposal was to deepen, mud up, and cement off a sand which carried "edge-water" in an adjoining well. Recommended that the company test the "edge sand" in order to determine its contents, and, in case water was found, that they cement a string of casing in the shale above the water sand in order to protect the upper oil sands. In case the "edge sand" was found to contain oil at this well, the proposed method by the company would be satisfactory, as long as they could prove that the upper oil sands were fully protected.

Well No. 15, shut-off. A-180.

A test was made, demonstrating that the "edge sand" at this well carried oil. Approved proposal to cement a string of casing below this sand.

Well No. 15, shut-off. A-212.

8¼" casing was cemented below the "edge sand." Test approved as satisfactory.

Well No. 37, redrill. AA-521.

Approved proposal to put in new oil string.

Well No. 44, redrill. AA-545.

Approved proposal to recement water string after shooting.

Mercantile Crude Oil Co.

Well No. 3, deepen. AA-331.

Approved proposal to deepen through oil sand which had formerly been encountered at a depth of 1065'.

Well No. 5, redrill. AA-353.

Approved proposal to shut off water above the "light sand."

Well No. 5, shut off. A-273.

The test failed to show conclusively that the water string had completely excluded the water from the well. Recommended that the company pump well for sixty days and furnish this department with a report showing the amount of water and oil produced each ten-day period during this time.

S. W. & B. Oil Co.
Well No. 1, redrill. AA-495.
Approved proposal to cut off 4½" oil string and redrill the well.
Well No. 6, redrill. AA-467.
Approved proposal to remove a liner and put in a new oil string.

New San Francisco Crude Oil Co.
Well No. 10, redrill. AA-354.
Approved proposal to pull out 6¼" oil string and replace it with shop-perforated casing.

York Coalinga Oil Co.
Well No. 6, redrill. AA-619.
Approved proposal to replace oil string.

SECTION 7.

Kern Trading & Oil Co.
Well No. 11, abandon. AA-385.
The company proposed to clean out the well to the top of a plug which had formerly been placed in the well. In case it was found that the cement had not set properly, it was proposed to redrill the well and remove as much of the 6⅝" casing as possible, leaving the well cased to the top of the oil sand with 8¼" casing. This proposal was approved.
Well No. 11, continue abandonment. AA-402.
A test witnessed by a member of this department showed that the cement plug formerly placed in this well had set properly. Approved proposal to remove 6⅝" casing.
Well No. 27, abandon. AA-445.
Approved proposal to abandon, specifying depths of shooting and plugging.
Well No. 27, abandon. AA-534.
Information for Report AA-445 was incomplete. Changes were made in depths of shooting and plugging, based on the additional information.

Arica Oil Co.
Well No. 8, redrill. AA-375.
Approved proposal to remove liner and redrill the well to original depth, in case the oil string was damaged while doing this.
Well No. 22, commence drilling. AA-554.
Proposed depth of water shut-off approved.
Well No. 22, shut-off. A-353.
Test of water shut-off satisfactory.
Well No. 43, shut-off. A-339.
10" casing was cemented 30' higher than was proposed and approved, and water was encountered below. Recommended company file proposal to shut off same.
Well No. 43, commence drilling. AA-518.
Proposed depth of water shut-off approved.
Well No. 43, cement deeper. AA-618.
Approved proposal to cement 20' deeper with 8¼".

Section Seven Oil Co.
Well No. 2, redrill. AA-417.
Approved proposal to carry oil string to depth at which well was originally drilled.
Well No. 3, redrill. AA-439.
The company proposed to remove the oil string, bridge the well, and shut off water and then redrill the well. Recommended that the company furnish a history of this well before commencing work of redrilling, in order that further study might be made of the proposal submitted by the company.
Well No. 3, redrill. AA-520.
Upon receipt of history the proposed redrilling was approved.

SECTION 8.

Coalinga National Petroleum Co.

Well No. 1, abandon. AA-624.

Approved abandonment as proposed. Requested notice for test of plug below bottom of 8¼". This plug was not tested by this department.

Well No. 2, commence drilling. AA-240.

Estimated depth of water shut-off approved.

Well No. 2, shut-off. A-256.

The test showed that water was not completely shut off with 10" casing. Recommended that the company make further tests in order to determine possible source of water entering the well.

Well No. 2, shut-off. A-266.

Test showed that water was shut-off with 8¼" casing, which was landed in the formation below the point at which 10" casing was cemented.

M. K. & T. Co.

Well No. 2, abandon. AA-563.

The company was found to be pulling casing from this well without notice or approval and without plugging to protect oil sands. After receiving report of work done, approval to abandon was given, specifying depths of shooting and plugging.

Well No. 2, abandon. AA-590.

The 4½" casing was found to be landed at a point other than reported. Approval was given to plug without shooting at this point.

Coalinga Eight Oil Co.

Well No. 2, redrill. AA-276.

Oil string and water string had collapsed above the point of shut-off. Approved proposal to plug lower portion of old hole with cement; cut off the 6¼" and 8¼" casing above the point of collapse; and recement 8¼" casing at about the same depth as originally cemented.

SECTION 11.

Kern Trading & Oil Co.

Well No. 31, shut-off. A-164.

On account of water content in production, recommended that the company pump the well for 30 days, at which time another production test would be witnessed and further recommendations made.

Well No. 31, shut-off. A-237.

Test showed that water from below a depth of 3860′ had been excluded from formations above this depth. Fluid produced by the well contained 1% water.

SECTION 12.

Coalinga Mohawk Oil Co.

Well No. 2, pull casing. AA-412.

Rejected proposal to pull casing, as no provision was made to protect oil-bearing formations which had been encountered in this well.

Well No. 3, redrill. AA-561.

Approved proposal to redrill and cement 6¼" casing after shooting to break up sidetracked casing.

Well No. 4, plug the bottom. AA-330.

Recommended that the company rip and shoot the lower portion of 6¼" casing and plug with cement in the formation between depths at which the well was shot; demonstrate that cement set properly before perforating upper oil sands formerly shut off.

Well No. 4, plug bottom of well. AA-472.

Proposal to plug above intermediate water approved. The necessity of plugging at a lower depth in case damage resulted was pointed out.

Well No. 4, abandon. AA-544.

Approved proposal to abandon after certain shooting and plugging.

Coalinga Mohawk Oil Co.

Well No. 5, redrill. AA-441.

Approved proposal to redrill well with 6¼" casing to a depth of about 4100'.

Well No. 5, deepen. AA-441 Supp.

Approved supplementary proposal to redrill to about 4170'.

Well No. 5, abandon. AA-503.

Approved proposal to abandon.

Well No. 7, plug off bottom of well. AA-277.

Proposal to plug off bottom water approved.

Well No. 7, shut-off. A-238.

The results of a production test showed that the fluid produced contained 3% water and that "bottom water" had been shut off.

Well No. 8, shut-off. A-279.

Test of water shut-off satisfactory.

Well No. 9, commence drilling. AA-477.

Proposed depth of water shut-off approved.

Well No. 10, commence drilling. AA-538.

Proposed depth of water shut-off approved.

Well No. 11, commence drilling. AA-625.

Proposed depth of water shut-off approved.

SECTION 16.

T. H. Pike.

Well No. 1, abandon. AA-212.

Approved proposal to abandon this well, indicating depths at which shooting and plugging should be done.

SECTION 17.

Oil Exploration Co.

Well No. 3, commence drilling. AA-359.

Recommended that water be shut off 20' deeper than proposed.

Well No. 3, shut-off. A-255.

Test of water shut-off satisfactory.

SECTION 18.

Lakeport Petroleum Co.

Well No. 1, redrill. AA-322.

Approved proposal to replace collapsed oil string.

Well No. 16, cement at about 2487'. AA-416.

Proposed depth of water shut-off approved.

Well No. 16, shut-off. A-265.

Approved test of water shut-off, stating that 5½ hours was not sufficient time to allow the well to stand for test and that in the future wells would be required to stand at least 12 hours.

Well No. 16, redrill. AA-636.

Approved proposal to put in new oil string.

Well No. 24, commence drilling. AA-431.

Proposed depth of water shut-off approved.

Nevada Petroleum Co.

Well No. 5C, abandon. AA-580.

Approved proposal to abandon. Recommended that plug under water string be tested by this department by filling hole to surface with water and allowing to stand 12 hours.

Well No. 5A, redrill. AA-549.

Approved proposal to redrill and shut-off water with 8¼".

Well No. 5A, redrill. AA-604.

Approved proposal to recement 8¼".

American Petroleum Co.

Well No. 4, set packer. AA-210.

Approved proposal to set packer on oil string to shut out top water.

American Petroleum Co.

Well No. 7, redrill. AA-379.

Approved proposal to replace collapsed oil string.

Well No. 7, redrill. AA-433.

Approved proposal to replace collapsed oil string.

Well No. 9, redrill and deepen. AA-327.

Approved proposal to cement below upper "edge-water" sand.

Well No. 29, redrill. AA-390.

Approved proposal to replace collapsed oil string.

SECTION 19.

Kern Trading & Oil Co.

Well No. 1, abandon. AA-484.

Approved proposal to abandon, indicating depths at which shooting and plugging should be done.

Well No. 3, shut-off. A-235.

A production test showed an improved condition of the well after setting packer. Recommended further pumping test.

Well No. 3, shut-off. A-360.

A production test indicated that top water was shut off.

Well No. 22, abandon. AA-485.

Approved proposal to abandon well, indicating depths at which shooting and plugging should be done.

Well No. 22, shut-off. A-331.

Test of "bottom-water" shut-off approved.

Well No. 30, remove 8" and place adapter. AA-391.

Approved proposal to remove $8\frac{1}{4}$" oil string and set adapter from 10" to $6\frac{5}{8}$" liner.

Well No. 38, redrill. AA-426.

Approved proposal to test water string and redrill to original depth.

Well No. 38, shut-off. A-302.

Test of water shut-off satisfactory. Shoe of water string located with latch jack.

American Petroleum Co.

Well No. 1, fluid level. A-317.

Test to determine depth to top of fluid.

Well No. 5, fluid level. A-316.

Test to determine depth to top of fluid.

Well No. 6, fluid level. A-314.

Test to determine depth to top of fluid.

Well No. 6, redrill. AA-579.

Approved proposal to put in new oil string.

Well No. 8, redrill. AA-560.

Approved proposal to pull oil string and test for source of water.

Well No. 8, redrill. AA-611.

Approved proposal to recement $8\frac{1}{4}$" if top water is found.

Well No. 8, abandon. AA-643.

Proposal to abandon approved. The hole was in such shape that it did not seem advisable to plug in the ordinary way to shut off water. It was recommended that the hole be cleaned out to bottom, the oil sands mudded up and the hole kept full of mud fluid, and that the 10" casing be left undisturbed.

Well No. 11, redrill. AA-275.

Approved proposal to test water string and set packer or make another shut-off, if found necessary.

Well No. 13, redrill. AA-380.

Approved proposal to replace oil string. Recommended that packer be set in case well was making its own water.

Well No. 15, redrill. AA-602.

Approved proposal to put in new oil string.

Well No. 17, redrill. AA-280.

Approved proposal to replace collapsed oil string.

Oil Exploration Co.

Well No. 4, commence drilling. AA-251.

Recommended that company shut water off about 2440′ instead of 2510′ as proposed.

Well No. 4, cement at about 2475′. AA-352.

After a conference of the company and neighboring operators, a proposal to cement at 2475′ was approved.

Well No. 4, as per letter attached. AA-387.

10″ casing cemented at 2475′ failed to shut off water. Approved proposal to drill ahead, prospecting for a suitable place to make another shut-off.

Well No. 4, shut-off. A-246.

Test of water shut-off satisfactory.

SECTION 20.

Nevada Petroleum Co.

Well No. 1, shut-off. A-185.

A production test showed a high percentage of water. A further pumping test was recommended.

Well No. 1, shut-off. A-224.

After increasing the fluid production, a test was made and further tests recommended.

Well No. 1, test for point of entrance of water. AA-659.

Approved proposal to test for point of entrance of water by introducing muddy water into the well and noting the point of entrance of clear water.

SECTION 30.

Creme Petroleum Co.

Well No. 1, correspondence.

See Creme complaint.

American Petroleum Co.

Well No. 1, N30, shut-off. A-252.

A production test showed the well to be making an excessive amount of water. Its source was undetermined.

Well No. 1, N30, redrill. AA-425.

Approved proposal to redrill to original depth and make further production test, and suggested that water string be tested before doing this work.

Well No. 1, N30, fluid level. A-289.

Test to determine depth to top of fluid.

Well No. 3, N30, fluid level. A-299.

Test to determine depth to top of fluid.

Well No. 5, N30, redrill. AA-432.

Approved proposal to replace collapsed oil string and redrill to original depth.

Well No. 5, N30, redrill. AA-541.

Approved proposal to recement water string.

Well No. 6, N30, fluid level. A-318.

Test to determine depth to top of fluid.

Well No. 7, N30, fluid level. A-294.

Test to determine depth to top of fluid.

Well No. 8, N30, fluid level. A-288.

Test to determine depth to top of fluid.

Well No. 9, N30, fluid level. A-285.

Test to determine depth to top of fluid.

Well No. 10, N30, fluid level. A-312.

Test to determine depth to top of fluid.

Well No. 11, N30, fluid level. A-313.

Test to determine depth to top of fluid.

American Petroleum Co.

Well No. 6, redrill. AA-321.

Approved proposal to recement water string.

Well No. 9, redrill. AA-649.

Approved proposal to recement water string.

Well No. 18, fluid level. A-287.

Test to determine depth to top of fluid.

Well No. 19, redrill. AA-437.

Approved proposal to pull packer and set new packer, if deemed advisable.

Well No. 24, fluid level. A-290.

Test to determine depth to top of fluid.

Nevada Petroleum Co.

Well No. 6, redrill. AA-334.

Approved proposal to test for source of water by bridging over oil sand and setting packer in shoe joint of water string.

Well No. 6, reset packer. AA-373.

Approved proposal to reset packer at a lower depth.

Well No. 6, fluid level. A-304.

Test to determine depth to top of fluid.

Well No. 7, redrill. AA-492.

Approved proposal to attempt to force cement back of water string to shut off top water.

Well No. 7, shut-off. A-293.

Well tested with hole open below shoe of water string into pocket of cement. After drilling ahead to cement bridge water came in, probably around cement bridge.

Well No. 4-A, redrill. AA-333.

Approved proposal to remove oil string and test water string.

Well No. 5-A, redrill. AA-332.

Approved proposal to remove oil string and test water string.

Well No. 5-A, shut-off. A-277.

Result of production test indicated that water was not completely shut off with hemp packer. Recommended further production test.

Well No. 7-A, shut-off. A-276.

Test of water shut-off satisfactory.

Well No. 8-A, redrill. AA-595.

Approved proposal to remove oil string, bridge, and test water string.

T. 20 S., R. 16 E., M. D. B. & M.

SECTION 18.

Southeastern Ltd. Oil Co.

Well No. 1, redrill. AA-370.

The work of pulling casing from this well was in progress when the attention of the company was called to the fact that no notice concerning this work had been filed. After receiving log and report of work done and notice covering further necessary work at the well, approval was given to continue removing casing after certain plugging had been done.

Well No. 1, discontinue redrilling. AA-393.

After doing a portion of the work recommended, the company stated that further progress below 3465' could not be made. Approval was given to discontinue work at this depth.

T. 21 S., R. 14 E., M. D. B. & M.

SECTION 12.

Fifty-seven Oil Co.

Well No. 1, abandon well. AA-514.

Approved proposal to remove surface equipment only.

SECTION 13.

Ben Williams.
Well No. 1, S. N. Root, abandon. AA-670.
Approved proposal to abandon, specifying depths of shooting and plugging.

T. 21 S., R. 15 E., M. D. B. & M.

SECTION 6.

California Oil & Gas Co.
Well No. 4, redrill. AA-666.
Approved proposal to replace collapsed oil string.
Well No. 7-A, commence drilling. AA-249.
Recommended depth of water shut-off 50′ deeper than proposed.
Well No. 7-A, shut-off. A-199.
Test of water shut-off satisfactory. Casing cemented at proposed depth.
Well No. 7-A, recement. AA-377.
Approved proposal to cement $8\frac{1}{4}$″ 100′ below 10″.
Well No. 7-A, shut-off. A-242.
Test of water shut-off satisfactory.
Well No. 7-A, redrill. AA-603.
Approved proposal to loosen oil string in effort to increase production and, if possible, locate source of water.

Lucile Oil Co.
Well No. 2, redrill. AA-260.
Approved proposal to redrill and test for source of water.

Marion Oil Co.
Well No. 1, redrilling. AA-617.
Proposal to redrill well and plug in bottom approved, specifying that plugging be done by stages and tested.

SECTION 8.

Associated Oil Co.
Well No. 5-H, commence drilling. AA-423.
Proposed depth of water shut-off approved.
Well No. 5-H, shut-off. A-296.
Test of water shut-off satisfactory.

SECTION 18.

Boychester Oil Co.
Well No. 1, perforate casing. AA-675.
Approved proposal to perforate oil string and remove upper portion of same. Recommended that in future notice be filed before commencing work.

R. L. Patterson (formerly property of Coalinga Gem Oil Co.)
Well No. 1, abandon. AA-457.
Approved proposal to abandon.

SECTION 22.

Bunting Iron Works.
Well No. 1, Coalinga Hub Oil Co., abandon. AA-537.
Approved proposal to abandon, specifying depths of shooting and plugging.

CHAPTER VI.

DIRECTORY OF OIL OPERATORS.

Showing Number of Producing Wells on December 31, 1916, Location of Properties, and Also Date of Incorporation and Capital Stock of Such as Are Incorporated.

(Star preceding name indicates that operator was a producer during the year 1916.)

***A. & J. OIL COMPANY,**
400 H. W. Hellman Bldg., Los Angeles, Cal. A. J. Jergins, President. H. J. Haase, Secretary. April 25, 1914, $80,000. Three wells, Kern County.

ÆTNA OIL, MINING AND DEVELOPING COMPANY.
256-8 Wilcox Bldg., Los Angeles, Cal. Wm. H. Smith, President. Dwight B. Harris, Secretary. May 14, 1913. $25,000.

ÆTNA PETROLEUM COMPANY,
350 California St., San Francisco, Cal. John Lawson, President. George S. Tyler, Secretary. April 20, 1899. $500,000 Orig. $500,000 Inc.

ALADDIN OIL COMPANY,
409 Consolidated Realty Bldg., Los Angeles, Cal. Wm. Mead, President. L. Schenck, Secretary. September 17, 1900. $250,000. Kern County.

***ALASKA PIONEER OIL COMPANY,**
435 Mills Bldg., San Francisco, Cal. Wm. Chappell, President. W. J. Clark, Secretary. March 18, 1910. $500,000. Six wells, Kern County.

ALBERTA MIDWAY OIL COMPANY,
1003 Higgins Bldg., Los Angeles, Cal. F. Chappellet, President. C. R. Stevens, Secretary. (Dissolved.)

ALLIANCE OIL COMPANY,
254 Pine St., San Francisco, Cal. L. A. Phillips, President. H. P. Coles, Secretary. July 22, 1909. $3,000,000.

***ALMA OIL COMPANY,**
517 Pacific Bldg., Oakland, Cal. C. E. Thomas, President. M. A. Thomas, Secretary. June 22, 1900. $400,000. Eighteen wells, Kern County.

ALMO OIL COMPANY,
Lemoore, Cal. J. McAdam, Jr., President. L. L. Follett, Secretary. June 23, 1904. $50,000.

ALTOONA MIDWAY OIL COMPANY,
Room 72 Altoona Trust Bldg., Altoona, Pa. R. W. A. Jamison, President. J. H. Fiske, Secretary. February 20, 1909. $500,000. Kern County.

ALVARADO OIL COMPANY,
1114 Union Oil Bldg., Los Angeles, Cal. L. H. Mitchell, President. V. C. McCollogh, Secretary. February 23, 1904. $300,000.

***AMALGAMATED OIL COMPANY,**
55 New Montgomery St., San Francisco, Cal. Wm. Sproule, President. P. G. Williams, Secretary. October 27, 1904. $5,000,000. Twenty-five wells, Orange County; six wells, Los Angeles County.

***AMAUROT OIL COMPANY,**
507 Foxcroft Bldg., San Francisco, Cal. William E. Miles, President. A. J. Weston, Secretary. Six wells, Kern County. (Dissolved; property operated by William E. Miles.)

AMAZON OIL COMPANY,
409 Citizens Savings Bank Bldg., Los Angeles, Cal. A. K. Nash, President. R. H. Pinney, Secretary. September 26, 1900. $400,000. Kern County.

AMBER OIL COMPANY,
803 Baker St., East Bakersfield, Cal. John Kincaid, President. S. K. Dickinson, Secretary. July 19, 1909. $500,000. Kern County.

AMERICAN CRUDE OIL COMPANY,
Room 1115, 456 S. Spring St., Los Angeles, Cal. January 3, 1912. $500,000. Kern County.

***AMERICAN OILFIELDS COMPANY,**
1034 Security Bldg., Los Angeles, Cal. T. A. O'Donnell, President. Norman Bridge, Secretary. January 10, 1910. $25,000,000. Forty-seven wells, Kern County.

***AMERICAN PETROLEUM COMPANY,**
1034 Security Bldg., Los Angeles, Cal. T. A. O'Donnell, President. Norman Bridge, Secretary. February 7, 1908. $10,000,000. Orig.; $15,000,000. Inc. Eighty-seven wells, Fresno County.

AMERICAN VENTURA OIL COMPANY,
452 J. W. Hellman Bldg., Los Angeles, Cal. J. M. Herndon, President. J. C. Miller, Secretary. Ventura County.

***AMITY OIL COMPANY,**
607 First National Bank Bldg., San Francisco, Cal. T. P. Woodward, President. A. Whearty, Secretary. August 31, 1911. $500,000. Six wells, Fresno County.

***AMY OIL COMPANY,**
Coalinga, Cal. A. P. May, President. C. E. Haliburton, Secretary. November 14, 1908. $50,000. One well, Fresno County.

ANCHOR OIL COMPANY,
Maricopa, Cal. Julius H. Preston, President. Bernard T. Lennon, Secretary. January 19, 1917. $300,000. Kern County.

ANGLO-CALIFORNIAN OIL SYNDICATE, LIMITED,
Bank of Lompoc Bldg., Lompoc, Cal. John Chapman, President. G. J. Stimson, Secretary. July 17, 1906. £50,000.

*APOLLO OIL COMPANY,
507 Foxcroft Bldg., San Francisco, Cal. William E. Miles, President. A. J. Weston, Secretary. February 13, 1901. $20,000. Twenty wells, Kern County.

*ARCTURUS OIL COMPANY,
55 New Montgomery St., San Francisco, Cal. Wm. Sproule, President. P. G. Williams, Secretary. February 12, 1904. $400,000. Twenty-five wells. Los Angeles County.

AREQUIPA OIL COMPANY,
58 Sutter St., San Francisco, Cal. O. Scribner, President. G. Sheridan, Secretary. January 5, 1909. $500,000. Kern County.

*ARICA OIL COMPANY,
55 New Montgomery St., San Francisco, Cal. R. P. Schwerin, President. J. P. Edwards, Secretary. January 5, 1909. $500,000. Ten wells, Fresno County.

*ARIZONA PETROLEUM COMPANY,
1122 Title Insurance Building, Los Angeles, Cal. J. A. Brown, President. E. W. Foogy, Secretary. March 13, 1910. $250,000. Seven wells, Fresno County.

*ASSOCIATED OIL COMPANY,
55 New Montgomery St., San Francisco, Cal. Wm. Sproule, President. P. G. Williams, Secretary. October 7, 1901. $40,000,000. Fifty-seven wells, Fresno County; 689 wells, Kern County.

ASSOCIATED OIL COMPANY OF NEVADA,
55 New Montgomery St., San Francisco, Cal. R. P. Schwerin, President. P. G. Williams, Secretary. October 2, 1916. $25,000.

ATLANTIC AND WESTERN OIL COMPANY,
Livermore, Cal. Wm. W. French, Agent. September 14, 1917. $1,000,000.

ATLAS CRUDE OIL COMPANY,
Title Insurance Bldg., Los Angeles, Cal. G. M. Giffen, President. Theo. A. Simpson, Secretary. July 14, 1900. $30,000.

AUGUST OIL COMPANY,
P. O. Box 635, Fresno, Cal. F. A. Homan, President. A. W. Burdick, Secretary. April 4, 1910. $1,000,000.

AUGUSTINE & BUTZ,
Box 152, Coalinga, Cal.

AVENAL LAND AND OIL COMPANY,
350 California St., San Francisco, Cal. John Lawson, President. R. D. Blake, Secretary. April 20, 1899. $500,000.

AZORES OIL COMPANY,
266 N. Douty St., Hanford, Cal. M. J. Caetano, President. Wilhelmina Nunes, Secretary. January 20, 1909. $50,000.

BABY KINGS OIL AND MINERAL COMPANY,
P. O. Box 416, Hanford, Cal. F. B. Skinner, President. W. R. McQuiddy, Secretary. December 8, 1897. $64,000.

*BAKER & HENSHAW,
Lost Hills, Cal. Two wells, Kern County.

BAKERSFIELD AND FRESNO OIL COMPANY,
Griffith-McKenzie Bldg., Fresno, Cal. H. M. Rodgers, President. F. E. Cook, Secretary. August 31, 1899. $100,000. Kern County.

BAKERSFIELD FUEL AND OIL COMPANY,
1805 Tucker St., Selma, Cal. W. H. Shafer, President. Chas. A. Lee, Secretary. July 31, 1899. $16,000.

BALBOA OIL COMPANY,
525 Spreckels Bldg., San Diego, Cal. A. J. Taylor, President. J. Wiseman, Secretary. June 10, 1912. $500,000.

BALD EAGLE JUNIOR OIL COMPANY,
P. O. Box 308, Napa, Cal. E. H. Winship, President. J. E. Beard, Secretary. February 1, 1901. $175,000.

*BALD EAGLE OIL COMPANY,
110 Sutter St., San Francisco, Cal. C. H. Phillips, President. Wm. Lange, Jr., Secretary. January 7, 1901. $500,000. Thirteen wells, Kern County.

*BANKERS OIL COMPANY,
703 Citizens National Bank Bldg., Los Angeles, Cal. Orra E. Monnette, President. M. J. Monnette, Secretary. November 24, 1909. $100,000. Thirty-four wells, Kern County.

*BANKLINE OIL COMPANY,
324 Sansome St., San Francisco, Cal. John Barneson, President. J. Leslie Barneson, Secretary. May 20, 1912. $200,000. Twenty-two wells, Kern County.

BANNER OIL COMPANY,
820 Union Oil Bldg., Los Angeles, Cal. J. H. Strine, President. Ruben S. Schmidt, Secretary. September 12, 1891. $10,000.

*BARD OIL AND ASPHALT COMPANY,
428 I. W. Hellman Bldg., Los Angeles, Cal. Edward Strasburg, Secretary. Twenty-two wells, Ventura County. (Dissolved.)

BARDSDALE CANYON OIL COMPANY,
300 Harvard Blvd., Los Angeles, Cal. Chas. F. Hurd, President. Thos. Pascoe, Secretary. May 16, 1901. $20,000.

*BARDSDALE CRUDE OIL COMPANY,
514 Federal Bldg., Los Angeles, Cal. A. F. Schiffman, President. Chas. A. Shaw, Secretary. June 18, 1900. $200,000. Seven wells, Ventura County.

BARNODON OIL COMPANY,
310 Sansome St., San Francisco, Cal. John Barneson, President. W. J. Dinsmore, Secretary. April 9, 1910. $1,000,000.

BARSTOW SAN ANTONIO OIL COMPANY,
9 Beech St., Detroit, Michigan, care W. L. Hogan. January 16, 1915. $100,000.

BARTOLO OIL COMPANY,
831 Merchants National Bank Bldg., Los Angeles, Cal. L. P. Tappeiner, President. G. C. O'Connell, Secretary. August 7, 1916. $100,000.

BAY CITY OIL COMPANY,
30 S. Raymond Ave., Los Angeles, Cal. J. H. Dorn, President. Ira J. H. Sykes, Secretary. October 28, 1899. $500,000. Kern County.

BEAR CREEK OIL COMPANY,
19 Howard Canfield Bldg., Santa Barbara, Cal. J. L. Hurlburt, President. A. R. Edmondson, Secretary. July 12, 1913. $10,000.

***BEATTY OIL AND DEVELOPMENT COMPANY,**
930 California Bldg., Los Angeles, Cal. S. W. Beatty, President. H. M. Foster, Secretary. February 10, 1913. $470,000. Two wells, Ventura County.

***BECKER, G. F.,**
Summerland, Cal. Sixty-three wells, Santa Barbara County.

BEDROCK OIL COMPANY,
1114 Union Oil Bldg., Los Angeles, Cal. W. W. Orcutt, President. John McPeak, Secretary. January 4, 1909. $50,000.

***BEER OIL COMPANY, J. C.,**
407 First National Bank Bldg., Long Beach, Cal. J. C. Beer, President. H. Hoddenpyle, Secretary. March 23, 1912. $100,000. Three wells, Kern County. (Property now operated by E. B. Campbell, Bakersfield, Cal.)

BELL OIL COMPANY,
363 Fay Bldg., Los Angeles, Cal. C. E. Lapp, President. J. W. Eberle, Secretary. July 2, 1910. $100,000.

BELMONT OIL COMPANY,
601 D St., Chino, Cal. O. J. Newman, President. Edwin Rhodes, Secretary. September 13, 1899. $200,000.

***BELRIDGE OIL COMPANY,**
617 Merritt Bldg., Eighth and Broadway, Los Angeles, Cal. Burton E. Green, President. W. J. Hole, Secretary. January 25, 1911. $1,000,000. Eighty wells, Kern County.

BEQUETTE OIL COMPANY,
Visalia, Cal. Paschal Bequette, President. N. F. Bradley, Secretary. January 16, 1900. $9,000.

BERKELEY COALINGA OIL COMPANY,
Care of W. L. W. Miller, 340 California St., San Francisco, Cal. Fresno County.

BERKELEY PARAFFINE OIL COMPANY,
1912 Haste St., Berkeley, Cal. Geo. H. De Kay, President. P. S. Brunk, Secretary. July 6, 1912. $1,000,000.

***BERRY, F. C.,**
Selma, Cal. Five wells, Kern County.

***BERRY, C. J. AND KELLER, F. L.,**
597 Monadnock Bldg., San Francisco, Cal. Sixteen wells, Kern County.

BEST YET OIL COMPANY, THE,
Coalinga, Cal. O. D. Loftus, President. Guy H. Salisbury, Secretary. October 29, 1909. $150,000.

***BETTS, GEO A.,**
R.F.D. No. 5, Bakersfield, Cal. Kern County.

***B. H. C. OIL COMPANY,**
208 Brower Bldg., Bakersfield, Cal. C. L. Claflin, President. W. H. Hill, Secretary. September 18, 1908. $15,000. Six wells, Kern County.

BIG LAKE OIL AND GAS COMPANY,
617 Merritt Bldg., Los Angeles, Cal. Care F. B. Sutton. August 1, 1917. $100,000.

BIG SESPE OIL COMPANY OF CALIFORNIA,
609 N. Main St., Santa Ana, Cal. I. D. Mills, Secretary. September 4, 1896. $500,000. Ventura County.

***BIRCH OIL COMPANY,**
R.F.D., Fullerton, Cal. A. Otis Birch, General Manager. Seven wells, Orange County. (Co-partnership.)

BLANCK & HEASLEY,
Care of Lawton & Blanck, Inc., Fellows, Cal. Kern County.

BLUE DIAMOND OIL COMPANY,
Grass Valley, Cal. W. G. Thomas, President. L. P. Lane, Secretary. October 15, 1900. $100,000.

BOHEMIAN OIL COMPANY,
220 N. Irwin St., Hanford, Cal. L. S. Chittenden, President. A. F. Flory, Secretary. (Dissolved.)

J. S. BOOK OIL AND INVESTMENT COMPANY,
521 Washington Bldg., Los Angeles, Cal. Dr. W. P. Book, President. G. E. Delavan, Jr., Secretary. February 8, 1913. $50,000.

***BOSTON-PACIFIC OIL COMPANY,**
204-5 Sharon Bldg., San Francisco, Cal. Fred G. King, President. E. B. Cushman, Secretary. December 12, 1911. $1,000,000. Two wells, Kern County.

***BOSTON PETROLEUM COMPANY,**
131 State St., Boston, Mass. Arthur Winslow, President. Henry L. Rand, Secretary. March 21, 1910. $500,000. Fourteen wells, Kern County.

BOYCHESTER OIL COMPANY,
Coalinga, Cal. W. C. Rielly, President. J. A. Fleutsch, Secretary. May 19, 1909. $100,000.

***BRAD OIL COMPANY, LTD.,**
Box 178, Taft, Cal. E. D. Taylor, Secretary. One well, Kern County. (Property sold to Montana-Wyoming Oil Company, October 11, 1917.)

BRADFORD OIL COMPANY,
110 Market St., Room 405, San Francisco, Cal. P. G. Goode, Vice-President. Louis Nathan, Secretary. May 17, 1899. $250,000.

***BREA CAÑON OIL COMPANY,**
1117 Trust and Savings Bldg., Los Angeles, Cal. Dan Murphy, President. G. Holterhoff, Jr., Secretary. July 26, 1899. $200,000. Twenty-two wells, Orange County.

BRICELAND OIL COMPANY,
Briceland, Cal. April 22, 1913. $150,000.

BRITISH AMERICAN OIL COMPANY,
Box 598, Santa Monica, Cal. Wm. Z. McDonald, President. Robert K. Walton, Secretary. August 26, 1907. $1,250,000. Orig.; $100,000, Dec. Kern County.

BRONCHO OIL COMPANY,
637 Holbrook Bldg., 58 Sutter St., San Francisco, Cal. Chas. A. San, President. A. N. Baldwin, Secretary. November 19, 1908. $100,000.

BRONCHO OIL LEASE,
801 Garland Bldg., Los Angeles, Cal. William G. Kerckhoff, Owner. Kern County.

*BROOKS OIL COMPANY,
Sisquoc, Cal. B. F. Brooks, President. One well, Santa Barbara County.

*BROOKSHIRE OIL COMPANY,
San Luis Obispo, Cal. J. W. Barneberg, President. Henry Bahr, Secretary. December 1, 1902. $500,000. Four wells, Kern County; 4 wells, Santa Barbara County.

BROWN EAGLE OIL COMPANY,
300 E. Main St., Visalia, Cal. John Frans, President. J. Sub Johnson, Secretary. February 10, 1910. $75,000.

BROWN OIL COMPANY,
Care Southern Hotel, Bakersfield, Cal. P. S. Brown, President. S. L. Mack, Secretary. January 29, 1900. $250,000.

*BUENA FE PETROLEUM COMPANY,
1015 Security Bldg., Los Angeles, Cal. T. A. O'Donnell, President. E. L. Doheny, Jr., Secretary. November 3, 1915. $10,000. Fifty-three wells, Kern County. (Property transferred to Pan-American Petroleum Company, October 18, 1917.)

BUENA VISTA OIL COMPANY,
519 Story Bldg., 610 S. Broadway, Los Angeles, Cal. J. M. McLeod, President. C. C. Barnsback, Secretary. July 23, 1914. $1,500,000. Kern County.

*BUICK OIL COMPANY,
520 Central Bldg., Los Angeles, Cal. W. J. Fabling, Vice-President. Fred Van Orman, Secretary. March 7, 1910. $5,000,000. Two wells, Kern County.

BULL DOG OIL COMPANY,
617 Merritt Bldg., Los Angeles, Cal. M. H. Whittier, President. H. L. Westbrook, Secretary. March 6, 1911. $300,000.

BUNKER HILL OIL MINING COMPANY,
110 Sutter St., San Francisco, Cal. J. W. Wright, President. Wm. Lange, Jr., Secretary. November 9, 1899. $500,000.

E. D. BURGE OIL COMPANY,
P. O. Box 813, Bakersfield, Cal. E. D. Burge, President. C. H. Franey, Secretary. December 11, 1914. $50,000.

CALEX OIL COMPANY,
1913 Chester Ave., Bakersfield, Cal. H. A. Jastro, President. E. S. St. Clair, Secretary. August 23, 1915. $24,000. Four wells, Kern County.

CALIENTE OIL AND LAND COMPANY,
Wright & Callender Bldg., Los Angeles, Cal. Care F. E. Davis. July 17, 1916. $50,000.

CALIDON PETROLEUM SYNDICATE,
350 California St., San Francisco, Cal. Two wells, Kern County. (Operated by the Balfour-Guthrie Investment Company, R. F. MacLeod, Secretary.)

CALIFORNIA COALINGA OIL COMPANY,
Monadnock Bldg., San Francisco, Cal. Care Wm. H. H. Hart. March 27, 1917. $3,000,000. Fresno County.

*CALIFORNIA COAST OIL COMPANY,
1114 Union Oil Bldg., Los Angeles, Cal. W. L. Stewart, President. John McPeak, Secretary. September 10, 1903. $200,000. Nine wells, Santa Barbara County.

*CALIFORNIA COUNTIES OIL COMPANY,
58 Sutter St., San Francisco, Cal. J. E. Woodbridge, President. E. A. Richards, Secretary. February 11, 1911. $500,000. Four wells, Kern County. (Sold to General Petroleum Corporation, August 1, 1917.)

CALIFORNIA-DAKOTA OIL COMPANY,
Kerman, Cal., John Hohn, President. Walter L. Hart, Secretary. October 27, 1913. $25,000.

CALIFORNIA FRESNO OIL COMPANY,
Box 823, Fresno, Cal. A. C. Ruschhaupt, President. A. Bultner, Secretary. October 31, 1901. $50,000.

*CALIFORNIA MIDWAY OIL COMPANY,
500 H. W. Hellman Bldg., Los Angeles, Cal. B. W. McCausland, President. J. H. Nolan, Secretary. January 13, 1912. $1,500,000. Three wells, Kern County.

CALIFORNIA MISSOURI PETROLEUM COMPANY,
108 Morgan Bldg., Bakersfield, Cal. Care Thomas Scott. December 17, 1917. $100,000.

CALIFORNIA OIL COMPANY,
532 Fifteenth St., Oakland, Cal. September 28, 1917. $4,000,000.

CALIFORNIA OIL AND ASPHALT COMPANY, THE,
242 Title Insurance Bldg., Los Angeles, Cal. Care Arthur M. Ellis. May 5, 1916. $50,000.

*CALIFORNIA OIL AND GAS COMPANY,
Coalinga, Cal. W. M. Graham, President. Warren H. Spurge, Secretary. February 9, 1912. $1,000,000. Three wells, Fresno County.

CALIFORNIA OIL DEVELOPMENT SYNDICATE,
326 Wilcox Bldg., Los Angeles, Cal. J. D. Miller, President. Janet I. Miller, Secretary. November 15, 1916. $3,000.

CALIFORNIA OIL LAND COMPANY, THE,
Exchange National Bank Bldg., Colorado Springs, Colo. Care Oliver H. Shoup. May 17, 1912. $50,000.

CALIFORNIA RELIANCE OIL COMPANY,
317 Tajo Bldg., Los Angeles, Cal. Thurston Daniels, President. Minnie Daniels, Secretary. April 11, 1910. $1,500,000.

*CALIFORNIA STAR OIL COMPANY,
1004 Security Bldg., Los Angeles, Cal. Thos. A. O'Donnell, President. Ellis T. Yarnell, Secretary. May 20, 1915. $2,000,000. Fifteen wells, Kern County.

CALIFORNIA WYOMING OIL COMPANY,
Box 468, Fresno, Cal. Care E. J. Crandall. April 10, 1917. $3,000.

*CALL OIL COMPANY,
Box 516, Coalinga, Cal. D. A. Ewing, President. W. O. Miles, Secretary. January 8, 1901. $250,000. Two wells, Fresno County.

*CALLOMA OIL COMPANY,
1913 Chester Ave., Bakersfield, Cal. H. A. Jastro, President. E. S. St. Clair, Secretary. February 15, 1904. $200,000. Five wells, Kern County.

*CALOKLA OIL COMPANY,
537 Title Insurance Bldg., Los Angeles, Cal. H. F. Sinclair, President. E. M. Riese, Secretary. November 5, 1913. $250,000. Five wells, Orange County.

CALTRONA OIL COMPANY,
409 Hosfield Bldg., Los Angeles, Cal. Herman P. Cortelyou, President. John W. Cooke, Secretarp. January 10, 1907. $8,000.

*CALUMET OIL COMPANY,
517 I. W. Hellman Bldg., Los Angeles, Cal. F. L. Wright, President. A. N. Gage, Secretary. April 7, 1911. $1,000,000. Six wells, Ventura County.

CAMARILLO OIL COMPANY,
210 W. Seventh St., Los Angeles, Cal. H. J. Doulton, President. L. N. Stott, Secretary. April 22, 1910. $100,000.

CAMPBELL, E. B.,
Bakersfield, Cal. (Operating property of J. C. Beer Oil Company.)

CAMERON OIL COMPANY OF CALIFORNIA,
408 Merchants Trust Bldg., Los Angeles, Cal. John Ferguson, President. H. S. McCallum, Secretary. April 23, 1914. $25,000.

*CANADIAN COALINGA OIL COMPANY, LTD.,
739 Hastings St., West, Vancouver, B. C. E. J. McFeely, President. R. J. Cromie, Secretary. October 10, 1910. A. J. Pollak, Agt. Box 159, Maricopa, Cal. $1,500,000. One well, Fresno County.

*CANADIAN PACIFIC OIL COMPANY OF BRITISH COLUMBIA, LTD.,
P. O. Box 27, Taft, Cal. W. H. Waddell, Field Manager. Three wells, Kern County.

CANTIN LAND, OIL AND DEVELOPMENT COMPANY,
Star Route, Sanger, Cal. Maud H. Lindsay, President. E. P. Lindsay, Secretary. February 8, 1910. $10,000.

*CAPITOL CRUDE OIL COMPANY,
637 Consolidated Realty Bldg., Los Angeles, Cal. M. H. Sherman, President. A. I. Smith, Secretary. April 26, 1894. $300,000. Sixteen wells, Ventura County.

*CARBO PETROLEUM COMPANY,
Box 4, Bakersfield, Cal. T. M. Young, President. G. R. Peckham, Secretary. July 15, 1909. $500,000. Ten wells, Kern County.

*CARIBOU OIL MINING COMPANY,
435 Mills Bldg., San Francisco, Cal. H. H. Hart, President. W. J. Clark, Secretary. June 3, 1899. $1,000,000. Twenty-one wells, Fresno County; 3 wells, Kern County.

CARPENTER, JACK,
Maricopa, Cal. C. H. Treat, Manager.

CARREC OIL COMPANY,
435 Mills Bldg., San Francisco, Cal. H. H. Hart, President. W. J. Clark, Secretary. September 25, 1914. $100,000.

CARRIE NATION OIL COMPANY,
Lemoore, Cal. L. Y. Trout, President. F. B. Graves, Secretary. December 23, 1908. $25,000.

CASCADE OIL COMPANY,
906 S. Hill St., Los Angeles, Cal. H. A. Dunn, President. Stone Hastain, Secretary. April 28, 1916. $10,000.

*CASMALIA SYNDICATE,
Sharon Bldg., San Francisco, Cal. R. P. Schwerin, President. P. G. Williams, Secretary. March 30, 1916. $1,000,000. Three wells, Santa Barbara County.

CASTLE OIL COMPANY,
1118 Hearst Bldg., San Francisco, Cal. H. A. Whitley, President. B. H. Henderson, Secretary. March 19, 1910. $600,000.

CAVE DALE OIL AND DEVELOPMENT COMPANY,
1332 Evans Ave., San Francisco, Cal. S. Pliser, President. H. Saxl, Secretary. December 8, 1914. $200,000.

CENTRAL CALIFORNIA OIL COMPANY,
1114 Union Oil Bldg., Los Angeles, Cal. Frank R. Barrett, President. May 22, 1886. $200,000.

*CENTRAL OIL COMPANY OF LOS ANGELES,
404 H. W. Hellman Bldg., Los Angeles, Cal. I. A. Lothian, President. Robert N. Bulla, Secretary. January 2, 1900. $750,000, Orig.; $3,000,000, Inc. Fifty-three wells, Los Angeles County.

*CHANSLOR-CANFIELD MIDWAY OIL COMPANY,
Room 756, Kerckhoff Bldg., Los Angeles, Cal. E. P. Ripley, President, G. Holterhoff, Jr., Secretary. August 15, 1901. $5,000,000. One hundred thirty-four wells, Kern County.

*CHENEY STIMSON OIL COMPANY,
806 Merchants National Bank Bldg., Los Angeles, Cal. A. L. Cheney, President. December 17, 1909. $100,000. Six wells, Kern County.

CHEROKEE DEVELOPMENT COMPANY,
533 Market St., San Francisco, Cal. R. C. Dorsey, Vice-President. J. H. Bingham, Secretary. December 9, 1903. $100,000. Kern County.

CHINO OIL COMPANY,
224 H. W. Hellman Bldg., Los Angeles, Cal. E. J. Marshall, President. John F. Horton, Secretary. October 18, 1907. $50,000.

C. H. Oil COMPANY,
435 Mills Bldg., San Francisco, Cal. Wm. Chappell, President. W. J. Clark, Secretary. December 5, 1911. $100,000.

*CIRCLE OIL COMPANY,
502 Balboa Bldg., San Francisco, Cal. T. A. O'Donnell, President. O. G. Myers, Secretary. April 10, 1908. $100,000. One well, Fresno County.

*CLAMPITT, E. A.,
1037 N. Alameda St., Los Angeles, Cal. Fifteen wells, Kern County; 32 wells, Los Angeles County.

CLAMPITT, E. A. & D. L.,
1037 N. Alameda St., Los Angeles, Cal.

*CLAREMONT OIL COMPANY,
1114 Union Oil Bldg., Los Angeles, Cal. W. L. Stewart, President. R. Bruce Wallace, Secretary. January 25, 1901. $100,000. Thirteen wells, Kern County; 7 wells, Fresno County.

COALINGA CENTRAL OIL COMPANY,
1913 Chester Ave., Bakersfield, Cal. E. S. St. Clair, President. F. C. St. Clair, Secretary. April 9, 1910. $600,000.

COALINGA CROWN OIL COMPANY,
2039 Mariposa St., Fresno, Cal. September 17, 1909. $300,000.

*COALINGA EIGHT OIL COMPANY,
Box 268, Coalinga, Cal. L. V. Olcese, President. H. Steinbach, Secretary. Two wells, Fresno County (Dissolved.)

*COALINGA EMPIRE OIL COMPANY,
Care Stanley Pedder, First National Bank Bldg., San Francisco, Cal. H. A. Whitley, President. Stanley Pedder, Secretary. October 28, 1914. $1,000,000. Two wells, Fresno County.

COALINGA FOUR OIL COMPANY,
Box 154, Los Alamos, Cal. May 8, 1907. $50,000.

*COALINGA HOMESTAKE OIL COMPANY,
Box 463, Coalinga, Cal. A. P. May, President. Geo. E. H. Satchell, Secretary. July 29, 1909. $100,000. Fresno County.

COALINGA HUB OIL COMPANY,
Box 463, Coalinga, Cal. Geo. Awalt, President. Geo. E. H. Satchell, Secretary. (Dissolved.)

COALINGA LOST HILLS OIL COMPANY,
P. O. Box 154, Los Alamos, Cal. January 4, 1911. $50,000.

COALINGA LUBRICATING OIL COMPANY,
403 Citizens National Bank Bldg., Los Angeles, Cal. R. A. Collins, President. G. H. Rathman, Secretary. January 27, 1917. $100,000.

*COALINGA MOHAWK OIL COMPANY,
Room 505, 830 Market St., San Francisco, Cal. Alfred L. Meyerstein, President. J. R. Fulton, Secretary. April 15, 1907. $500,000. Four wells, Fresno County.

*COALINGA MONTEREY OIL COMPANY,
201 Main St., Salinas, Cal. E. A. Nickerson, President. Luther Rodgers, Secretary. March 17, 1910. $2,000,000. Two wells, Kern County.

COALINGA NATIONAL PETROLEUM COMPANY,
310 Sansome St., San Francisco, Cal. John Barneson, President. Virgil F. Shaw, Secretary. May 8, 1909. $500,000. Fresno County.

*COALINGA NORTH POLE OIL COMPANY,
Box 692, Fresno, Cal. L. W. Wilson, Secretary. October 2, 1909. $50,000. One well, Fresno County.

*COALINGA PACIFIC OIL AND GAS COMPANY,
607 First National Bank Bldg., San Francisco, Cal. Robert Hays Smith, President. G. J. Bliss, Secretary. August 4, 1903. $165,000. Two wells, Fresno County.

*COALINGA PEERLESS OIL COMPANY,
824 Crocker Bldg., San Francisco, Cal. Gordon Bradley, Assistant Secretary. (Property sold to Standard Oil Co.)

*COALINGA PETROLEUM COMPANY,
Coalinga, Cal. A. A. Baker, Secretary. January 23, 1905. $75,000. Five wells, Fresno County.

COALINGA SECURITY OIL COMPANY, THE,
919 Investment Bldg., Los Angeles, Cal. F. E. Woodruff, President. C. H. McWilliams, Secretary. February 25, 1910. $300,000. Fresno County. (Property leased to Union Oil Company.)

*COALINGA STAR OIL COMPANY,
1004 Security Bldg., Los Angeles, Cal. Thos. A. O'Donnell, President. Ellis T. Yarnell, Secretary. May 10, 1916. $200,000. Eleven wells, Fresno County.

*COALINGA SYNDICATE OIL COMPANY,
433 California St., San Francisco, Cal. R. K. Barrows, President. A. E. Boynton, Secretary. June 28, 1911. $2,500,000. Two wells, Fresno County.

*COALINGA UNITY OIL COMPANY,
Sharon Bldg., San Francisco, Cal. P. G. Williams, Secretary. September 24, 1909. $200,000. Three wells, Fresno County.

COAST RANGE OIL COMPANY,
701 Washington Bldg., Los Angeles, Cal. Mary B. Cates, President. Alton M. Cates, Secretary. May 10, 1890. $1,000,000, Orig.; $10,000, Dec. Fresno County.

COLONIA OIL COMPANY OF OXNARD, CALIFORNIA,
Box A, Oxnard, Cal. A. Levy, President. R. W. Witman, Secretary. September 13, 1909. $200,000.

*COLORADO OIL COMPANY,
Care Merchants National Bank, San Diego, Cal. Ralph Granger, President. J. E. Hasbrouck, Secretary. December 22, 1909. $200,000. Fourteen wells, Los Angeles County.

COLORADO-PACIFIC DEVELOPMENT COMPANY,
337 Deseret News Annex, Salt Lake City, Utah. J. H. Hunt, President. L. A. Maison, Secretary. December 5, 1907. $1,000,000.

*COLUMBIA OIL PRODUCING COMPANY,
303 Tajo Bldg., Los Angeles, Cal. W. B. Scott, President. W. Astley, Secretary. May 28, 1900. $3,500,000. Forty-five wells, Los Angeles County; 61 wells, Orange County.

*COMBINED OIL COMPANY,
849 Phelan Bldg., San Francisco, Cal. Philip C. Boardman, President. George J. Hausen, Secretary. May 29, 1911. $500,000. Eight wells, Kern County.

*COMMERCIAL PETROLEUM COMPANY,
120 Market St., San Francisco, Cal. M. L. Woy, President. W. P. Roth, Secretary. July 27, 1896. $250,000. Seven wells, Fresno County.

COMSTOCK CRUDE OIL COMPANY,
421 Kerckhoff Bldg., Los Angeles, Cal. L. N. Comstock, President. N. J. Hudson, Secretary. November 2, 1912. $500,000.

*CONFIDENCE OIL COMPANY,
P. O. Box 867, Fresno, Cal. D. S. Ewing, President. A. W. Burdick, Secretary. May 13, 1899. $48,000. Five wells, Fresno County.

CONSERVATIVE DEVELOPMENT COMPANY,
Care C. E. Price, Wilcox Bldg., Los Angeles, Cal. L. W. Myers, President. C. E. Price, Secretary. February 27, 1903. $200,000, Orig.; $20,000, Dec.

*CONSERVATIVE OIL COMPANY,
2223 Nineteenth St., Bakersfield, Cal. C. Brubaeher, President. E. L. Weed, Secretary. March 1, 1905. $62,500. Two wells, Kern County.

*CONSOLIDATED MUTUAL OIL COMPANY,
544 Market St., San Francisco, Cal. Louis Titus, President. C. F. Nance, Secretary. February 16, 1914. $3,000,000. Three wells, Kern County.

CONSOLIDATED OIL AND DEVELOPMENT COMPANY,
637 Monadnock Bldg., San Francisco, Cal. Dr. L. M. F. Wanzer, President. J. C. Cullen, Secretary. August 14, 1896. $50,000.

*CONSOLIDATED OIL LANDS COMPANY,
433 California St., San Francisco, Cal. Chas. W. Gardner, President. A. E. Boynton, Secretary. April 27, 1911. $5,000,000. Two wells, Fresno County.

*CONTINENTAL OIL AND MINERAL COMPANY,
1055 Market St., San Francisco, Cal. M. Spiegleman, President. G. W. Forsyth, Secretary. July 14, 1914. $100,000. One well, Santa Clara County. (Property now operated by Rhoads & Schmitt.)

CONTINENTAL OIL COMPANY OF LOS ANGELES.
Care C. E. Price, Wilcox Bldg., Los Angeles, Cal. A. D. Elwell, President. C. E. Price, Secretary. December 16, 1899. $300,000.

CONTINENTAL PETROLEUM COMPANY,
Merchants Exchange Bldg., San Francisco, Cal. Care D. Hadsell, December 15, 1917. $200,000.

CONTRA COSTA OIL SYNDICATE,
Care J. E. Rodgers, Martinez, Cal. October 20, 1917. $100,000.

COPA DE ORO PETROLEUM COMPANY,
512 California Bldg., Los Angeles, Cal. G. M. Lane, President. W. A. Butterworth, Secretary. December 12, 1914. $450,000.

COPECK OIL COMPANY,
310 Sansome St., San Francisco, Cal. John Barneson, President. J. Leslie Barneson, Secretary. January 8, 1909. $500,000.

COSMO OIL COMPANY,
Box 267, Hanford, Cal. W. K. Knapp, President. F. B. Cunningham, Secretary. April 29, 1909. $100,000.

*COSMOPOLITAN OIL COMPANY,
510 Douglas Bldg., Los Angeles, Cal. G. L. Holton, President. Robt. G. Holton, Secretary. May 1, 1912. $400,000. Two wells, Ventura County.

CRAFTON OIL COMPANY,
Mentone, Cal. J. R. Baird, Jr., President. A. R. Schultz, Secretary. February 17, 1911. $25,000.

CREE OIL COMPANY,
617 Merritt Bldg., Los Angeles, Cal. Burton E. Green, President. F. B. Sutton, Secretary. June 1, 1903. $5,000,000, Orig.; $1,000,000, Dec.

*CRESCEUS OIL COMPANY,
579 I. W. Hellman Bldg., Los Angeles, Cal. P. E. Spellacy, President. W. M. Wallace, Secretary. March 7, 1907. $320,000. Four wells, Kern County.

CRESCENT PETROLEUM COMPANY,
408 S. Fifth St., Coalinga, Cal. Care Henry S. Richmond. February 29, 1916. $50,000.

*CRITES, ARTHUR S. (Trustee),
Bakersfield, Cal. Eight wells, Kern County (formerly Linda Vista Oil Company); 6 wells, Kern County (formerly Piedmont Oil Company).

CROWN OF THE VALLEY OIL COMPANY,
Box 613, Pasadena, Cal. C. J. Willett, President. R. D. Badger, Secretary. March 2, 1900. $300,000. Orange County.

CROW OIL COMPANY,
2726 Hillegass Ave., Berkeley, Cal. C. E. Crow, President. R. B. Marshall, Secretary. April 25, 1900. $400,000.

CUBBON OIL COMPANY,
421 N. Main St., Santa Ana, Cal. John Cubbon, President. J. G. Quick, Secretary. September 24, 1900. $200,000.

*DABNEY & COMPANY, JOSEPH B.,
605 Union Oil Bldg., Los Angeles, Cal. Joseph Dabney, Owner. Seventeen wells, Kern County.

DABNEY OIL COMPANY,
1126 Marsh-Strong Bldg., Los Angeles, Cal. John R. Wilson, President. John S. Mitchell, Secretary. May 31, 1901. $1,000,000. Kern County.

DAYTON OIL COMPANY OF OHIO,
371 W. First St., Dayton, Ohio. Geo. M. Smart, President. G. Frank Kuhno, Secretary. October 15, 1908. $200,000. Kern County.

*DEL REY OIL COMPANY,
Room 6, Union Savings Bank Bldg., Pasadena, Cal. Alex. Miller, President. John C. Dalton, Secretary. December 19, 1900. $1,000,000. Nine wells, Kern County.

DEL SABLE OIL COMPANY,
530 Davis St., San Francisco, Cal. Louis Getz, President. Louis Nathan, Secretary. November 24, 1899. $250,000.

DELANEY OIL COMPANY, H. L.,
Brea, Orange County, Cal. Care Jay E. Sexton. January 25, 1918. $100,000,000.

DE LUXE OIL COMPANY,
P. O. Box 867, Fresno, Cal. George Kaehler, President. A. W. Burdick, Secretary. December 2, 1908. $100,000.

*DEVILS DEN CONSOLIDATED OIL COMPANY,
510 Crocker Bldg., San Francisco, Cal. Geo. T. Cameron, President. R. A. Morton, Secretary. February 2, 1900. $103,000. Twelve wells, Kern County.

DEVILS DEN DEVELOPMENT COMPANY,
Care A. H. Murray, Visalia, Cal. May 18, 1900. $125,000.

DIAMOND OIL COMPANY,
201-202 Bradbury Bldg., Los Angeles, Cal. E. R. Kellam, President. E. H. Miller, Secretary. January 17, 1916. $25,000.

DIAMOND TIP OIL COMPANY,
Reedley, Cal. G. A. Gallaher, President. Harry F. Winnes, Secretary. March 26, 1910. $12,000.

*DIAMOND VALLEY OIL COMPANY,
626 S. Spring St., Los Angeles, Cal. Charles M. Hoff, President. Melvin Bartlett, Secretary. February 3, 1911. $1,000,000. One well, Ventura County.

DIRECTORS OIL COMPANY,
401 Union Oil Bldg., Los Angeles, Cal. E. R. Snyder, President. F. C. Lamb, Secretary. March 9, 1899. $12,000.

DIXIE OIL COMPANY,
121 E. Main St., Visalia, Cal. A. Levis, President. Adolph D. Sweet, Secretary. February 3, 1900. $100,000.

*D. J. OIL COMPANY,
532 Fifteenth St., Oakland, Cal. B. B. Dudley, President. E. R. Arner, Secretary. June 13, 1912. $40,000. Two wells, Kern County; 2 wells, San Luis Obispo County. (Property sold to California Oil Company.)

DOAN, WHITAKER & LAYMANCE,
1432 Broadway, Oakland, Cal.

DOHENY PACIFIC PETROLEUM COMPANY,
1032 Security Bldg., Los Angeles, Cal. E. L. Doheny, President. August 15, 1917. $5,000,000. Kern County, Ventura County and Santa Barbara County.

*DOMINION OIL COMPANY,
21-23 Drumm St., San Francisco, Cal. W. J. Moore, President. A. J. Ranken, Secretary. January 20, 1910. $250,000. Three wells, Kern County.

DORAN, BROUSE & PRICE,
456 S. Spring St., Los Angeles, Cal. E. A. Doran, President. R. Tudor, Secretary. February 12, 1903. $40,000.

DUDLEY OIL COMPANY,
261 California St., San Francisco, Cal. John C. Ils, President. William Kahn, Secretary. October 3, 1907. $10,000.

*DUDLEY PETROLEUM COMPANY, B. B. & E. R.,
Twelfth and Franklin Sts., Oakland, Cal. E. R. Dudley, President. E. R. Arner, Secretary. March 11, 1914. $2,000,000. Thirteen wells, Kern County. (Property sold to the California Oil Company.)

*DUNHAM, A. M.,
Box 44, Santa Paula, Cal. Three wells, Ventura County.

DUNLOP OIL COMPANY, THE,
1002 Crocker Bldg., San Francisco, Cal. C. H. Holbrook, Jr., President. Wm. L. McGuire, Secretary. November 26, 1909. $200,000. Eight wells, Kern County.

*DUQUESNE OIL COMPANY,
124 W. Fourth St., Los Angeles, Cal. R. D. Herron, Vice President and Manager. (Company failed and lost charter.)

*EAGLE CREEK,
519 D St., Bakersfield, Cal. W. H. Cooley, Secretary. Ten wells, Kern County. (Disincorporated; property sold to Standard Oil Company.)

EAGLE HILL OIL COMPANY,
204 Severance Bldg., Los Angeles, Cal. Chas. Kestner, President. E. V. T. Sens, Secretary. December 29, 1916. $100,000.

EAGLET OIL COMPANY,
255 Holbrook Bldg., 58 Sutter St., San Francisco, Cal. J. A. Weston, President. S. G. O. King, Secretary. February 27, 1901. $300,000, Orig.; $50,000, Dec. Kern County.

EAST OAKLAND OIL COMPANY,
1430 Twenty-third Ave., Oakland, Cal. August 28, 1908. $10,000.

EAST PUENTE ANNEX OIL COMPANY,
412 Bumiller Bldg., Los Angeles, Cal. A. L. Ellis, Vice-President. July 17, 1916. $100,000.

*EAST PUENTE OIL COMPANY,
208 Granger Block, San Diego, Cal. Geo. R. Harrison, President. Geo. R. Rogers, Secretary. March 25, 1901. $500,000. Twenty-three wells, Kern County.

EAST SAN EMIDIO OIL LAND COMPANY,
347 Title Insurance Bldg., Los Angeles, Cal. Chas. A. Cole, President. W. S. McGiffert, Secretary. April 20, 1911. $50,000.

EAST WHITTIER OIL COMPANY,
404 H. W. Hellman Bldg., Los Angeles, Cal. W. W. Neuer, President. Robt. N. Bulla, Secretary. May 21, 1900. $250,000.

ECHO BREA OIL COMPANY,
204 Severance Bldg., Los Angeles, Cal. A. C. Labrie, President. E. V. T. Sens, Secretary. October 16, 1912. $100,000.

*EDMONDS MIDWAY OIL COMPANY,
406 Wilcox Bldg., Los Angeles, Cal. A. B. Barret, President. C. P. Campbell, Secretary. May 27, 1910. $1,500,000. One well, Kern County.

*EIGHT OIL COMPANY, THE,
P. O. Box OO, Bakersfield, Cal. S. P. Wible, President. Mr. Klipstein, Secretary. March 22, 1909. $50,000. Kern County.

ELAINE OIL COMPANY,
Box 207, Coalinga, Cal. March 7, 1907. $300,000.

*EL CAMINO OIL AND DEVELOPMENT COMPANY,
228 First National Bank Bldg., Oakland, Cal. W. V. Harrington, President. A. W. Beam, Secretary. October 26, 1910. $600,000. Three wells, Kern County.

ELDEE OIL COMPANY,
Room 637, 58 Sutter St., San Francisco, Cal. Chas. G. Wilcox, President. Louis Nathan, Secretary. September 15, 1908. $500,000.

EL DORA OIL COMPANY,
Box 352, Bakersfield, Cal.

*EL DORADO OIL COMPANY,
597 Monadnock Bldg., San Francisco, Cal. W. J. Berry, President. J. R. Murphy, Secretary. March 4, 1899. $100,000.

ELECTRA OIL COMPANY,
Room 637, Holbrook Bldg., 58 Sutter St., San Francisco, Cal. Chas. G. Wilcox, President. Louis Nathan, Secretary. November 20, 1908. $500,000.

*ELIM OIL COMPANY,
Union Oil Bldg., Los Angeles, Cal. J. P. Willis, President. L. M. Stewart, Secretary. September 12, 1912. $50,000. One well, Ventura County.

*ELK HORN OIL COMPANY,
Box 8, Taft, Cal. R. E. Graham, President. G. C. Patton, Secretary. March 13, 1908. $300,000. Three wells, Kern County.

ELK RIDGE OIL COMPANY,
903 Grattan St., Los Angeles, Cal. March 17, 1910. $10,000.

*ELLIOTT LEASE,
310 Sansome St., San Francisco, Cal. Virgil F. Shaw, Secretary. Three wells, Kern County.

ELSINORE AND TEMESCAL OIL AND LAND COMPANY,
304 Bryson Bldg., Los Angeles, Cal. Care Ben White. November 10, 1913. $100,000.

*EMPIRE GAS AND FUEL COMPANY,
410 Brower Bldg., Bakersfield, Cal. R. A. Broomfield, President. E. C. Reed, Secretary. October 9, 1912. $100,000. Two wells, Kern County.

EMPIRE OIL COMPANY,
1118 Hearst Bldg., San Francisco, Cal. H. A. Whitley, President. B. H. Henderson, Secretary. February 4, 1909. $2,000.

*EMPIRE OIL COMPANY,
637 Consolidated Realty Bldg., Los Angeles, Cal. Five wells, Ventura County. (Co-partnership.)

ENCINAL OIL COMPANY,
414 Marsh-Strong Bldg., Los Angeles, Cal. E. S. Shattuck, President. Wm. J. Nimmo, Secretary. May 2, 1907. $1,000,000.

*ENGINEERS OIL COMPANY,
519-21 Consolidated Realty Bldg., Los Angeles, Cal. F. C. Kingsbury, President. C. M. Dull, Secretary. March 28, 1911. $220,000. Five wells, Kern County.

ENOS OIL COMPANY,
278 Russ Bldg., San Francisco, Cal. Jno. Baker, Jr., President. I. Sutcliffe, Secretary. May 1, 1909. $500,000. Six wells, Kern County.

ENSIGN OIL COMPANY,
284 Perry St., San Francisco, Cal. E. J. Ensign, President. L. E. Ensign, Secretary. May 13, 1914. $100,000.

ENTERPRISE LAND AND OIL COMPANY,
58 Sutter St., San Francisco, Cal. J. Goldman, Treasurer-Superintendent. November 7, 1899. $200,000.

EQUITABLE PETROLEUM COMPANY,
1029 Title Insurance Bldg., Los Angeles, Cal. James Shultz, President. Donald Baker, Secretary. October 3, 1908. $100,000. Kern County.

*ETHEL D. COMPANY,
597 Monadnock Bldg., San Francisco, Cal. C. J. Berry, President. D. S. Ewing, Secretary. September 13, 1909. $1,000,000. Twenty-one wells. Kern County.

ETZENHAUSER OIL COMPANY,
300 E. Main St., Visalia, Cal. L. Lucier, President. J. Sub Johnson, Secretary. October 13, 1909. $75,000.

*EUCLID OIL COMPANY,
619 Union Oil Bldg., Los Angeles, Cal. M. V. McQuigg, President. A. J. Wallace, Secretary. August 8, 1900. $350,000. Six wells, Kern County.

EUREKA CRUDE OIL COMPANY,
1037 N. Alameda St., Los Angeles, Cal. Henry A. Greene, Secretary. December 26, 1916. $10,000.

EXPLORATION OIL COMPANY,
201 Sansome St., San Francisco, Cal. Dorsey Ash, President. Walter Loewy, Secretary. March 25, 1909. $200,000, Orig.; $400,000, Inc.

EXTENSION OIL COMPANY,
417 Chamber of Commerce Bldg., Los Angeles, Cal. Julius Fried, President. W. W. Worthing, Secretary. April 13, 1910. $1,000,000. Kern County.

*FAIRBANKS OIL COMPANY,
1264 Tamalpais St., Berkeley, Cal. H. W. Fairbanks, President. Robt. H. Wetmore, Secretary.

FAIRFIELD OIL COMPANY,
30 E. Forty-second St., New York, N. Y. (Property sold August, 1916.)

FAIRFIELD PETROLEUM COMPANY,
1015 Security Bldg., Los Angeles, Cal. E. L. Doheny, Jr., President. O. D. Bennett, Secretary. April 10, 1916. $10,000. Nineteen wells, Kern County.

FAITHFUL OIL COMPANY,
1416 Nineteenth St., Bakersfield, Cal. Chas. E. Lee, Vice President. A. Weill, Secretary. May 20, 1909. $25,600.

FAR WEST OIL COMPANY,
1114 Union Oil Bldg., Los Angeles, Cal. D. T. Perkins, President. W. L. Stewart, Secretary. June 1, 1891. $50,000.

FEDERAL OIL COMPANY,
1003 Higgins Bldg., Los Angeles, Cal. John Barneson, President. John A. Ferguson, Secetary. (Dissolved.)

*FETHER, F. A.,
Box 125, R.F.D. No. 5, Bakersfield, Cal.

*FETTERMAN OIL COMPANY,
G. C. Fetterman, Manager, 307 Grant Bldg., Los Angeles, Cal. Three wells, Orange County. (Dissolved.)

FIVE THIRTY-SIX OIL COMPANY,
1047 Monadnock Bldg., San Francisco, Cal. June 6, 1907. $100,000. Kern County.

F. M. J. OIL COMPANY,
Box 115, Bakersfield, Cal. J. W. Briscoe, President. J. A. Hughes, Secretary. April 27, 1911. $25,000.

FORT WAYNE CALIFORNIA OIL COMPANY,
510 S. Los Robles Ave., Pasadena, Cal. W. J. Randall, President. Chas. Pfuffia, Secretary. September 30, 1908. $300,000. Kern County.

*4 OIL COMPANY,
507 Foxcroft Bldg., San Francisco, Cal. William E. Miles, President. A. J. Weston, Secretary. April 19, 1900. $30,000. Twelve wells, Kern County.

*FOX AND GARRETT OIL COMPANY,
R.F.D. No. 5, Bakersfield, Cal. G. S. Butler, President. R. L. Burdic, Secretary. January 3, 1910. $150,000. Two wells, Kern County.

FOX OIL COMPANY,
Lompoc, Cal. A. Lehmann, President. E. L. Walley, Secretary. November 12, 1909. $440,000. Kern County.

FRESNO MIDWAY LAND AND OIL COMPANY,
County Auditor's Office, Fresno, Cal. Care of S. L. Hogue, Secretary. February 17, 1908. $25,000.

*FULLERTON GREAT WEST OIL COMPANY,
213 Owl Drug Bldg., San Diego, Cal. A. J. Bradley, President. W. E. Hinkle, Secretary. March 6, 1914. $500,000. Three wells, Orange County.

*FULLERTON OIL COMPANY,
Box 34, Fullerton, Cal. Jno. J. Fay, Jr., President. W. L. Valentine, Secretary. February 26, 1907. $600,000. Nineteen wells, Orange County.

FULLERTON OIL COMPANY (Los Angeles),
831 Merchants National Bank Bldg, Los Angeles, Cal. Jno. J. Fay, Jr., President. W. L. Valentine, Secretary. May 8, 1899. $25,000.

FULTON FUEL AND ROAD OIL COMPANY,
Care A. J. Coogan, 904 Merchants Exchange Bldg., San Francisco. John B. Wandell, President. Herbert N. Leach, Secretary. January 17, 1912. $400,000. (Operated by Melita Oil Company.)

FUTURE SUCCESS OIL COMPANY,
Coalinga, Cal. R. Baker, President. A. A. Baker, Secretary. May 3, 1913. $100,000.

*GARBUTT OIL COMPANY,
914 Merchants National Bank Bldg., Los Angeles, Cal. Frank A. Garbutt, President. Moye W. Stephens, Secretary. November 1, 1907. $500,000. Three wells, Los Angeles County.

GARNER MADISON OIL COMPANY,
1025 Citizens National Bank Bldg., Los Angeles, Cal. Care Ben S. Hunter. January 11, 1918. $75,000.

GATO RIDGE OIL COMPANY,
433 California St., San Francisco, Cal. Chas. W. Gardner, President. A. E. Boynton, Secretary. June 18, 1910. $1,000,000.

GENERAL PETROLEUM COMPANY,
1003 Higgins Bldg., Los Angeles, Cal. John Barneson, President. C. R. Stevens, Secretary. March 30, 1910. $50,000,000.

*GENERAL PETROLEUM CORPORATION,
1003 Higgins Bldg., Los Angeles, Cal. John Barneson, President. C. R. Stevens, Secretary. May 25, 1916. $16,702,400. Twenty-two wells, Fresno County; 215 wells, Kern County; 37 wells, Orange County.

*A. F. GILMORE COMPANY,
700 Van Nuys Bldg., Los Angeles, Cal. E. B. Gilmore, Manager and Secretary. February 3, 1915. $50,000. Twenty wells, Los Angeles County.

*GILROY OIL COMPANY,
522 Security Bldg., Los Angeles, Cal. S. C. Graham, President. S. E. Brobst, Secretary. Six wells, Santa Clara County. (Dissolved.)

GLACIER PETROLEUM COMPANY,
501 Investment Bldg., Los Angeles, Cal. Oliver O. Clark. June 28, 1917. $9,600.

GLOBE OIL COMPANY,
619 Union Oil Bldg., Los Angeles, Cal. M. V. McQuigg, President. A. J. Wallace, Secretary. April 11, 1906. $600,000. Kern County.

GOLDEN STATE OIL COMPANY,
2334 East Twenty-seventh St., Los Angeles, Cal. S. A. Thompson, President. S. E. Keiser, Secretary. December 16, 1915. $50,000.

GOLD SEAL PETROLEUM COMPANY,
905 Haas Bldg., Los Angeles, Cal. John Rome, President. O. Park Smith, Secretary. January 19, 1915. $450,000.

*GOOD LUCK OIL COMPANY,
948 Market St., San Francisco, Cal. James Madison, President. Albert Albrecht, Secretary. January 17, 1905. $100,000. Five wells, Fresno County.

*GOOD ROADS OIL COMPANY,
208 Brower Bldg., Bakersfield, Cal. W. H. Hill, President. C. A. Barlow, Secretary. January 5, 1914. $50,000. Eight wells, Kern County.

GRADOR OIL COMPANY,
12 South Fair Oaks Ave., Pasadena, Cal. S. C. Graham, President. Arthur N. Gage, Secretary. August 16, 1908. $250,000.

GRAHAM-LOFTUS OIL COMPANY,
Santa Paula, Cal. S. C. Graham, President. Allan C. McKevitt, Secretary. December 19, 1898. $40,000 Orig. $1,600,000 Inc. Orange County.

*J. E. GRAY ESTATE,
S. A. Gray, General Manager, Box 263, Bakersfield, Cal. Twenty-six wells, Kern County.

J. E. GRAY OIL COMPANY,
P. O. Box 263, Bakersfield, Cal. S. A. Gray, President. G. W. Gray, Secretary. January 13, 1909. $100,000. Twenty-six wells, Kern County.

GREAT REPUBLIC OIL AND PAINT COMPANY,
619 Brockman Bldg., Los Angeles, Cal. M. F. Tufts, Secretary.

*GUARDIAN OIL COMPANY,
343 Sansome St., San Francisco, Cal. H. H. Beers, President. R. A. Lewin, Secretary. March 20, 1915. $500,000. Eleven wells, Fresno County.

GUTHREY OIL COMPANY,
1001 Insurance Exchange, San Francisco, Cal. G. W. McNear, Jr., President. J. P. Rothwell, Secretary. January 5, 1906. $150,000.

*HALE-McLEOD OIL COMPANY,
926 Story Bldg., Los Angeles, Cal. Nathan W. Hale, President. F. V. Gordon, Secretary. September 29, 1909. $1,500,000. Fourteen wells, Kern County.

HAMILTON OIL & GAS COMPANY OF LOS ANGELES.
El Centro, Cal. December 28, 1908. $100,000.

HANFORD DEVIL'S DEN OIL COMPANY,
Care Hanford Water Co., Hanford, Cal. May 1, 1917. $75,000.

*HANFORD-SANGER OIL COMPANY,
514 I. W. Hellman Bldg., Los Angeles, Cal. F. R. Dunlap, President. H. E. Woods, Secretary. January 31, 1901. $300,000. Four wells, Kern County.

HANHUTH OIL COMPANY,
Vallejo, Cal. Wm. Hanhuth, President. Minnie Hanhuth, Secretary. November 17, 1916. $50,000.

HARBOR CRUDE OIL COMPANY,
836 H. W. Hellman Bldg., Los Angeles, Cal. W. F. Young, President. C. W. DeFreest, Secretary. July 3, 1913. $1,000,000.

HARLIND OIL COMPANY,
Room 1402, Humboldt Bank Bldg., San Francisco, Cal. Chas. M. Lindsay, President. S. N. Norton, Secretary. January 27, 1910. $250,000. Kern County.

*HARRIS AND STEVENS CORPORATION,
926 Black Bldg., Los Angeles, Cal. C. C. Harris, President. C. P. E. Menzies, Secretary. March 19, 1914. $75,000. Fourteen wells, Kern County.

C. C. HARRIS OIL COMPANY,
701 College St., Los Angeles, Cal. Mary B. Cates, President. E. R. Snyder, Secretary. February 10, 1909. $500,000.

HARTER OIL COMPANY,
322 Stimson Bldg., Third and Spring Sts., Los Angeles, Cal. Anthony Schaub, President. E. Roberts, Secretary. September 22, 1900. $250,000.

HAVILAND CRUDE OIL COMPANY,
416 Pacific Electric Bldg., Los Angeles, Cal. Care S. J. White. March 11, 1908. $25,000.

HAWAIIAN OIL COMPANY,
120 Market St., San Francisco, Cal. W. P. Roth, Secretary. June 28, 1909. $250,000. Kern County.

HAZELTON CRUDE OIL COMPANY,
Bakersfield, Cal. J. W. Kelly, President. Ida M. Kelly, Secretary. November 23, 1908. $25,000.

HENDERSON OIL COMPANY,
922 Kohl Bldg., San Francisco, Cal. Benj. Bangs, President. Thomas C. Berry, Secretary. June 19, 1908. $500,000. Santa Barbara County.

*HENDERSON UNION OIL COMPANY,
724 S. Main St., Los Angeles, Cal. E. E. Henderson, President. W. F. Wilson, Secretary. March 20, 1911. $100,000. Four wells, Ventura County.

HENRIETTA OIL COMPANY,
824 Mills Bldg., San Francisco, Cal. Oliver Ellsworth, President. M. A. Thomas, Secretary. October 2, 1900. $200,000. Kern County.

HICKLER OIL COMPANY,
404 S. Raymond Ave., Pasadena, Cal. W. I. Hollingsworth, President. W. H. Smidden, Secretary. February 28, 1901. $200,000.

*HIDALGO OIL COMPANY,
307 Insurance Bldg., San Francisco, Cal. F. B. Chapin, President. C. H. Sherman, Secretary. July 19, 1913. $100,000. One well, Ventura County.

HIGHLAND DEVELOPMENT COMPANY,
546 Title Insurance Bldg., Los Angeles, Cal. John W. Kinne, President. Milford Steele, Secretary. December 29, 1915. $10,000.

HIGHLAND OIL COMPANY,
Care L. L. Cory, Fresno, Cal. L. L. Cory, President. E. Owen, Secretary pro tem. October 13, 1899. $200,000.

HILLCREST OIL COMPANY,
Howard Canfield Bldg., Santa Barbara, Cal. E. H. Sawyer, President. A. R. Edmondson, Secretary. May 2, 1910. $500,000.

HILL TOP OIL COMPANY,
Santa Paula, Cal. I. B. Marhn, President. April 21, 1909. $100,000.

*HOME OIL COMPANY,
Whittier, Cal. T. H. Buckmaster, President. Alva Starbuck, Secretary. June 19, 1897. $100,000. Thirteen wells. Los Angeles County.

HOME RANCH PETROLEUM COMPANY,
923 I. N. Van Nuys Bldg., Los Angeles, Cal. S. A. Guiberson, Jr., President. January 12, 1917. $200,000.

*HOMESTEAD DEVELOPMENT COMPANY,
433 California St., San Francisco, Cal. Chas. W. Gardner, President. A. E. Boynton, Secretary. May 29, 1911. $500,000. Nine wells, Fresno County.

*HONDO OIL COMPANY,
617 Merritt Bldg., Los Angeles, Cal. M. L. Whittier, President. H. L. Westbrook, Secretary. July 19, 1916. $100,000. Twelve wells, Kern County.

*HONOLULU CONSOLIDATED OIL COMPANY,
120 Market St., San Francisco, Cal. A. C. Dierickx, President. W. P. Roth, Secretary. April 19, 1910. $5,000,000. Thirty-nine wells, Kern County.

HONOLULU OIL COMPANY,
120 Market St., San Francisco, Cal. A. M. McCarty, President. W. P. Roth, Secretary. June 28, 1909. $250,000.

HOPKINS OIL COMPANY,
Santa Maria, Cal. W. A. Haslam, President. Geo. Beach, Secretary. July 15, 1907. $75,000.

HUMAUMA OIL COMPANY,
310 Sansome St., San Francisco, Cal. Harry B. Gregg, Vice President. F. Klamp, Secretary. April 16, 1910. $1,000,000.

HUTCHINSON PETROLEUM CORPORATION,
303 International Bank Bldg., Los Angeles, Cal. Care Roger Marchetti. November 13, 1916. $10,000.

IBEX OIL COMPANY,
701 College St., Los Angeles, Cal. Mary B. Cates, President. E. R. Snyder, Secretary. August 25, 1908. $10,000.

*IDA MAY OIL COMPANY,
Box 58, Maricopa, Cal. Arthur Brand, Secretary.

IDEAL OIL COMPANY,
1028 Chorro St., San Luis Obispo, Cal. Care P. A. H. Arata. July 15, 1907. $50,000.

*ILLINOIS CRUDE OIL COMPANY,
Room 25, Bank of Bakersfield Bldg., Bakersfield, Cal. T. V. Doub, President. C. E. Arnold, Secretary. July 12, 1901. $200,000. Nine wells, Kern County.

IMPERIAL OIL COMPANY,
350 Mills Bldg., San Francisco, Cal. J. J. Mack, President. H. Steinbach, Secretary. August 14, 1899. $100,000.

*INCA OIL COMPANY,
58 Sutter St., San Francisco, Cal. Burton E. Green, President. M. B. Downing, Secretary. February 26, 1904. $100,000, Orig.; $750,000, Inc. Thirty-four wells, Fresno County.

*INDIAN AND COLONIAL DEVELOPMENT COMPANY, LIMITED, THE,
Taft, Cal. Arthur Farish, President. W. G. Clegg, Secretary. December 22, 1911. £1,000. Twenty wells, Kern County.

INDIAN VALLEY OIL COMPANY,
San Miguel, Cal. J. T. Densmore, President. E. Bergemann, Secretary. April 22, 1909. $50,000.

*INTERSTATE OIL COMPANY,
1011 Wright & Callender Bldg., Los Angeles, Cal. D. W. Wickersham, President. Floyd G. White, Secretary. November 14, 1913. $200,000. Three wells, Kern County.

INVESTMENT DEVELOPMENT COMPANY, THE,
406 Insurance Exchange Bldg., San Francisco, Cal. Samuel Pond, President. Albert Meyer, Secretary. January 3, 1911. $100,000.

INVESTMENT OIL COMPANY,
406 Insurance Exchange Bldg., San Francisco, Cal. S. H. Morsehead, President. Samuel Pond, Secretary. July 20, 1899. $500,000.

IOWA OIL COMPANY,
109 N. Greenleaf, Whittier, Cal. September 7, 1900. $200,000.

JOHN IRWIN OIL COMPANY,
Hueneme, Ventura County, Cal. E. O. Gerberding, Secretary. May 10, 1893. $30,000.

J. M. S. OIL LEASE,
310 Sansome St., San Francisco, Cal. Virgil F. Shaw, Secretary. Kern County.

*JACKSON OIL COMPANY,
Reward P.O., Kern County, Cal. S. P. Wible, President. D. A. Jackson, Secretary. October 18, 1907. $50,000. Seven wells, Kern County.

JADE OIL COMPANY, THE,
1008 Security Bldg., Los Angeles, Cal. R. B. Williamson, President. Geo. L. Reynolds, Secretary. October 16, 1908. $1,000,000. Kern County. (Property leased to Empire Gas & Fuel Company and J. A. Lydell.)

*JEFFERSON OIL COMPANY,
L. L. Richard, Owner, Coalinga, Cal. Two wells, Fresno County.

JESSE YARNELL COMPANY,
134 S. Bonnie Brae St., Los Angeles, Cal. Susan C. Yarnell, President. Catherine Yarnell, Secretary. April 8, 1907. $40,000.

*JEWETT OIL COMPANY,
Box 205, Bakersfield, Cal. Philo L. Jewett, President. A. Weill, Secretary. August 25, 1900. $500,000. Eight wells, Kern County.

JOHNSON OIL COMPANY,
P.O. Box 1083, Fresno, Cal. E. Schwarz, President. R. D. Marshall, Secretary. December 4, 1908. $100,000.

JORDAN OIL COMPANY,
Box 193, Arcade Station, Los Angeles, Cal. James T. Jordan, President. Ralph Martin, Secretary. May 25, 1907. $100,000.

JOSEPHINE OIL COMPANY,
1131 Investment Bldg., Los Angeles, Cal. Care of C. F. Whittier. July 24, 1916. $25,000.

*JUNCTION OIL COMPANY,
58 Sutter St., San Francisco, Cal. J. Goldman, President. S. G. O. King, Secretary. February 7, 1900. $250,000. Nine wells, Kern County.

KAISER OIL COMPANY,
1114 Union Oil Bldg., Los Angeles, Cal. W. W. Orcutt, President. John McPeak, Secretary. March 8, 1909. $100,000. Santa Barbara County.

*KALISPELL MIDWAY OIL COMPANY,
P.O. Box 441, Bakersfield, Cal. R. O. Wilson, President. A. C. Tupman, Secretary. July 12, 1910. $250,000. Three wells, Kern County.

KANAWHA OIL COMPANY,
208 Pacific Electric Bldg., Los Angeles, Cal. John M. Sands, President. S. R. Shoup, Secretary. August 8, 1910. $500,000. One well, Kern County. (Property sold to Spellacy & Thompson.)

K. AND V. OIL COMPANY,
P.O. Box 482, Visalia, Cal. Susman Mitchell, President. A. Q. Beals, Secretary. March 1, 1909. $100,000.

*KANSAS CRUDE OIL COMPANY,
F. L. Sawyer, Treasurer. Independence, Kansas. One well, Los Angeles County.

KAWEAH OIL DEVELOPMENT COMPANY,
P.O. Box 482, Visalia, Cal. H. A. Scott, President. A. Q. Beals, Secretary. March 22, 1909. $100,000.

KEITH AND MACK OIL COMPANY,
350 Mills, Bldg., San Francisco, Cal. A. Mack, President. H. Steinbach, Secretary. December 4, 1907. $20,000.

KEITH OIL AND LAND COMPANY,
350 Mills Bldg., San Francisco, Cal. A. Mack, President. H. Steinbach, Secretary. November 8, 1900. $200,000.

KELLOGG OIL COMPANY,
933 Van Nuys Bldg., Los Angeles, Cal. F. R. Kellogg, President. G. J. Syminton, Secretary. December 9, 1910. $50,000.

KERN CANON OIL COMPANY,
P.O. Box 235, Fresno, Cal. S. R. La Rue, President. F. L. Simons, Secretary. March 6, 1909. $75,000. Kern County.

KERN CENTRAL OIL COMPANY,
Room 1012 Mills Bldg., San Francisco, Cal. W. A. Brace, President. J. W. McFaughey, Secretary. December 21, 1899. $100,000.

*KERN CROWN COMPANY,
Box 323, Bakersfield, Cal. Catherine Sutherland, President. December 20, 1915. $20,000. Three wells, Kern County.

*KERN FOUR OIL COMPANY,
519-21 Consolidated Realty Bldg., Los Angeles, Cal. F. C. Kingsburg, President. C. M. Dull, Secretary. May 26, 1909. $100,000. Twenty-two wells, Kern County.

KERN PETROLEUM COMPANY,
Room 43, Carson Block, Eureka, Cal. February 17, 1910. $250,000.

KERN PUNCHEN OIL COMPANY,
2033 Mariposa St., Fresno, Cal. February 27, 1913. $200,000.

KERN RIVER DRILLERS OIL COMPANY,
310 Sansome St., San Francisco, Cal. March 3, 1909. $100,000. Kern County.

KERN RIVER OIL COMPANY,
238 Merchants Exchange Bldg., San Francisco, Cal. H. A. Voorman, President. E. C. Landis, Secretary. June 29, 1899. $100,000. Kern County.

*KERN RIVER OILFIELDS OF CALIFORNIA, LIMITED, THE,
1117 Investment Bldg., Los Angeles, Cal. Wm. Ivey, President. Reginald H. Young, Secretary. July 6, 1910. $2,908,325. Two hundred forty-nine wells, Kern County.

KERN SUNSET OIL COMPANY,
Maricopa Bank Bldg., Maricopa, Cal. March 27, 1908. $100,000 Orig. $10,000 Dec.

*KERN TRADING AND OIL COMPANY,
65 Market St., San Francisco, Cal. W. R. Scott, President. G. L. King, Secretary. May 22, 1903. $10,000,000. One hundred sixteen wells, Fresno County; 391 wells, Kern County. (Now operated by the Southern Pacific Company, Fuel Oil Department.)

KINGS RIVER OIL COMPANY,
R.F.D. B, Box 489, Fresno, Cal. Burton Elwood, President. Mrs. J. C. Marlar, Secretary. June 5, 1899. $100,000.

KNICKERBOCKER OIL COMPANY,
60 California St., San Francisco, Cal. J. D. Spreckels, Jr., President. G. B. Waterman, Secretary. March 15, 1911. $400,000. Kern County.

*KNOB HILL OIL COMPANY,
201 Cory Bldg., Fresno, Cal. James Forteous, President. W. J. Kittrell, Secretary. August 6, 1900. $25,000. Thirty wells, Kern County.

KOPJE OIL COMPANY,
Box 1306, Fresno, Cal. Geo. S. Waterman, President. M. M. Dearing, Secretary. January 4, 1901. $100,000. Kern County.

KRAMER CONSOLIDATED OIL COMPANY,
403 Germain Bldg., 224 S. Spring St., Los Angeles, Cal. J. J. Morris, President. D. F. Wilson, Secretary. November 2, 1900. $150,000 Orig. $600,000 Inc.

KRAMER MODEL OIL COMPANY,
Room 403 Germain Bldg., 220 S. Spring St., Los Angeles, Cal. Lester S. Moore, President. Chas. J. Merritt, Secretary. April 29, 1910. $21,000.

LA BELLE OIL COMPANY,
714 Central Bldg., Los Angeles, Cal. March 5, 1909. $100,000.

*LA BLANC OIL COMPANY, THE,
228 First National Bank Bldg., Oakland, Cal. J. C. Downey, President. W. V. Harrington, Secretary. October 1, 1908. $250,000. Two wells, Kern County.

LABONGE, R. F.,
Kentuck Lease, Fillmore, Cal.

LACEY OIL COMPANY,
First National Bank, Hanford, Cal. J. E. Hall, President. R. V. Hall, Secretary. November 1, 1909. $500,000.

LA CORONA OIL AND ASPHALT COMPANY,
1809 Chester Ave., Bakersfield, Cal. L. V. Olcese, President. J. B. Hewitt, Secretary. October 9, 1897. $19,000.

LAGUNA OIL COMPANY,
California Fruit Bldg., Sacramento, Cal. Care Devlin & Devlin. April 19, 1917. $50,000.

LA HABRA OIL COMPANY,
119 E. Colorado St., Pasadena, Cal. L. P. Hansen, President. Leo G. MacLaughlin, Secretary. April 6, 1910. $500,000.

*LAKEPORT PETROLEUM COMPANY,
Farmers Bank Bldg., Fresno, Cal. W. F. Chandler, President. H. H. Welsh, Secretary. May 20, 1916. $100,000. One well, Fresno County.

LAKESHORE OIL COMPANY,
510 Crocker Bldg., San Francisco, Cal. Geo. T. Cameron, President. R. A. Morton, Secretary. October 22, 1909. $750,000. (Operated by Universal Oil Company.)

LAKE VIEW ANNEX OIL COMPANY,
622 Bumiller Bldg., Los Angeles, Cal. November 21, 1910. $2,000,000.

*LAKE VIEW No. 2 OIL COMPANY,
405 S. Hill St., Los Angeles, Cal. C. H. White, President. F. G. White, Secretary. May 11, 1910. $1,000,000. Two wells, Kern County.

*LAKE VIEW OIL COMPANY,
1114 Union Oil Bldg., Los Angeles, Cal. W. L. Stewart, President. John McPeak, Secretary. December 9, 1908. $2,500,000. Four wells, Kern County.

LENNON OIL COMPANY,
120 W. D St., Coalinga, Cal. Care H. R. Crozier. January 15, 1907. $75,000.

LE ROY OIL COMPANY,
241 Sansome St., San Francisco, Cal. M. C. Hunter, President. Phil Heuer, Secretary. February 8, 1913. $100,000.

LIBERTY BELL OIL COMPANY,
502 First National Bank Bldg., Oakland, Cal. Care M. E. Bruner. May 5, 1916. $1,000,000.

LIBERTY OIL AND REFINING COMPANY,
812 Syndicate Bldg., Oakland, Cal. Care Peck, Bunker & Cole. October 30, 1917. $200,000.

LIGHT OIL EXTENSION COMPANY,
Room 637, 58 Sutter St., San Francisco, Cal. Louis Nathan, President. Chas. G. Wilcox, Secretary. November 25, 1908. $500,000.

*LILLIS, J. E.,
Summerland, Cal. Ten wells, Santa Barbara County.

LINCOLN OIL COMPANY,
708 Hibernian Bldg., Los Angeles, Cal. Care John S. Steely. October 15, 1917. $10,000.

LINDA VISTA OIL COMPANY,
1206 Broadway, Oakland, Cal. E. A. Heron, President. A. H. Breed, Secretary. November 23, 1900. $250,000.

LINDSAY INCORPORATED OIL COMPANY,
Lindsay, Cal. L. A. Sturgeon, President. L. G. Stallings, Secretary. November 11, 1909. $200,000.

LION OIL COMPANY,
474 N. First St., San Jose, Cal. S. W. Waterhouse, President. Annie C. Waterhouse, Secretary. September 2, 1914. $25,000. (In process of dissolution.)

*LISCOMB & BRIDGE,
1183 Garfield Ave., Pasadena, Cal. A. H. Liscomb, Managing Partner. Five wells, Kern County.

LITTLE JACK OIL COMPANY,
305 E. Sixth St., Hanford, Cal. Care Schnereger & Downing. May 16, 1912. $100,000.

LITTLE SESPE CONSOLIDATED OIL COMPANY,
407 Mason Bldg., Los Angeles, Cal. O. W. Roberts, President. W. P. Martin, Secretary. August 1, 1905. $30,000. Ventura County.

LOMA OIL COMPANY,
648 S. Olive St., Los Angeles, Cal. Frank A. Garbutt, President. Samuel C. Hall, Secretary. October 14, 1895. $50,000.

LOMPOC MONARCH OIL COMPANY,
349 Rialto Bldg., San Francisco, Cal. Howard A. Broughton, President. L. Huseman, Secretary. May 25, 1914. $1,000,000.

LOMPOC OIL DEVELOPING COMPANY,
Lompoc, Cal. Care F. J. Miller, Secretary. September 4, 1900. $300,000.

LOPEZ CANYON OIL COMPANY,
74 New Montgomery St., San Francisco, Cal. Care A. L. Darrow. February 14, 1907. $500,000.

LOS ALAMOS PETROLEUM COMPANY,
1004 Title Insurance Bldg., Los Angeles, Cal. Oliver C. Edwards, President. J. E. Wallis, Secretary. October 2, 1907. $500,000.

LOS ANGELES CHEROKEE OIL COMPANY,
1117 Trust and Savings Bldg., Los Angeles, Cal. Dan Murphy, President. G. Holterhoff, Jr., Secretary. (Dissolved.)

LOS ANGELES COALINGA OIL SYNDICATE,
307 Severance Bldg., Los Angeles, Cal. W. C. Elderton, President. W. W. Pedder, Secretary. July 8, 1909. $60,000.

*LOS ANGELES KERN OIL COMPANY,
1007 Haas Bldg., Los Angeles, Cal. M. W. Harker, President. H. W. Pettebone, Secretary. December 10, 1908. $400,000. Five wells, Kern County. (Dissolved.)

LOS ANGELES OIL COMPANY,
1114 Union Oil Bldg., Los Angeles, Cal. W. L. Stewart, President. October 23, 1874. $1,000,000, Orig.; $50,000, Dec.

LOS FLORES LAND AND OIL COMPANY,
510 Crocker Bldg., San Francisco, Cal. R. N. Bishop, President. R. A. Morton, Secretary. July 25, 1902. $1,000,000. Santa Barbara County.

*LOST HILLS DEVELOPMENT COMPANY,
National Bank of Visalia Bldg., Visalia, Cal. Daniel Calcote, President. E. C. Farnsworth, Secretary. Thirty-seven wells, Kern County. (Dissolved.)

LOST HILLS INVESTMENT COMPANY,
58 Sutter St., San Francisco, Cal. O. Scribner, Secretary. December 20, 1911. $24,000.

LOST HILLS MINING COMPANY,
510 Crocker Bldg., San Francisco, Cal. Geo. T. Cameron, President. R. A. Morton, Secretary. March 12, 1909. $36,800, Orig.; $100,000, Inc. (Operated by Universal Oil Company.)

*LOWELL OIL COMPANY,
58 Sutter St., San Francisco, Cal. A. N. Baldwin, Secretary.

LUCILE OIL COMPANY,
P. O. Box 37, Coalinga, Cal. Ida R. Robertson, President. February 23, 1905. $50,000. Three wells, Fresno County.

LUCKY BOY OIL COMPANY,
632 Wesley Roberts Bldg., Los Angeles, Cal. C. Wesley Roberts, President. Wm. K. Weaver, Secretary. September 14, 1909. $750,000. Kern County.

*MAINE STATE OIL COMPANY,
1001 Insurance Exchange, San Francisco, Cal. F. W. McNear, President. J. P. Rothwell, Secretary. January 16, 1900. $250,000. Four wells, Fresno County.

MAJESTIC OIL COMPANY,
Santa Maria, Cal. F. C. Twitchell, President. Geo. P. Merritt, Secretary. June 15, 1907. $500,000.

*M. & T. OIL COMPANY,
703 Syndicate Bldg., Oakland, Cal. E. N. Moor, President. Stuart S. Hawley, Secretary. January 15, 1910. $300,000. Three wells, Kern County.

*MAMMOTH OIL COMPANY,
597 Monadnock Bldg., San Francisco, Cal. J. R. Murphy, Assistant Secretary. Five wells, Kern County.

MANHATTAN MIDWAY OIL COMPANY,
1101 Hibernian Bldg., Los Angeles, Cal. S. E. Vermilyea, President. E. E. Edmonds, Secretary. January 2, 1909. $75,000. Kern County. (Dissolved.)

*MANLEY & McGINN,
597 Monadnock Bldg., San Francisco, Cal. J. R. Murphy, Agent. Ten wells, Kern County.

MARATHON OIL COMPANY,
First National Bank Bldg., Dinuba, Cal. E. C. Snell, President. Karl R. Dennis, Secretary. May 19, 1909. $75,000.

MARIAN OIL COMPANY OF COALINGA,
Coalinga, Cal. O. D. Loftus, President. J. A. Fluetsch, Secretary. March 25, 1909. $150,000. Fresno County.

MARICOPA INVESTMENT COMPANY,
P. O. Box 17, Maricopa, Cal. W. J. Schultz, President. E. L. Weed, Secretary. May 25, 1910. $25,000. Kern County.

*MARICOPA NATIONAL PETROLEUM COMPANY,
P. O. Box 411, Fresno, Cal. A. S. Cleary, President. E. V. Williams, Secretary. February 16, 1910. $400,000. Two wells, Kern County.

MARICOPA NORTHERN OIL COMPANY,
347 Title Insurance Bldg., Los Angeles, Cal. C. J. Heyler, President. M. M. Miles, Secretary. August 21, 1914. $1,000,000.

MARICOPA OIL COMPANY OF CALIFORNIA,
Napa, Cal. W. J. Schutz, President. Theo. W. Bernhard, Secretary. December 11, 1915. $100,000.

MARICOPA QUEEN OIL COMPANY,
216 Marine Bank Bldg., Long Beach, Cal. A. H. Smith, President. Otis Frey, Secretary. October 8, 1910. $1,000,000.

*MARICOPA STAR OIL COMPANY,
1001 Security Bldg., Los Angeles, Cal. Thos. A. O'Donnell, President. Ellis T. Yarnell, Secretary. October 29, 1913. $100,000. Four wells, Kern County.

*MARICOPA 36 OIL COMPANY,
310 Sansome St., San Francisco, Cal. O. H. Greenewald, President. Wm. Herlitz, Secretary. February 3, 1910. $250,000. One well.

MARINA OIL COMPANY,
324 Sansome St., San Francisco, Cal. John Barneson, President. J. Leslie Barneson, Secretary. November 25, 1916. $500,000.

MARION OIL COMPANY,
706 Flat Iron Bldg., San Francisco, Cal. Henry Ach, President. A. A. Power, Secretary. November 5, 1908. $600,000. Kern County.

*MASCOT OIL COMPANY,
597 I. W. Hellman Bldg., Los Angeles, Cal. T. Spellacy, President. P. E. Spellacy, Secretary. November 11, 1901. $50,000. Thirty-six wells, Kern County.

MAXWELL OIL COMPANY,
716 Sheldon Bldg., San Francisco, Cal. A. F. L. Bell, President. Albert W. Potts, Secretary. January 27, 1910. $250,000.

*MAY, FRANK,
861 Wenonah Ave., Pasadena, Cal. Seven wells, Kern County.

*MAY OIL COMPANY,
409 Consolidated Realty Bldg., Los Angeles. Wm. Mead, President. L. Schenck, Secretary. May 7, 1902. $200,000. Eight wells, Kern County.

MAYS CONSOLIDATED OIL COMPANY,
307 Insurance Bldg., San Francisco, Cal. F. B. Chapin, President. C. H. Sherman, Secretary. May 19, 1911. $100,000.

*McCUTCHEN BROS.,
Maricopa, Cal. Geo. W. McCutchen, Secretary. Eight wells, Kern County.

*McQUIGG BROS.,
616 Union Oil Bldg., Los Angeles, Cal. H. M. McQuigg, Manager. Six wells, Kern County.

McKITTRICK EXTENSION OIL COMPANY,
1527 Nineteenth St., Bakersfield, Cal. S. P. Wible, President. C. Brower, Secretary. November 1, 1900. $350,000.

McKITTRICK FRONT OIL COMPANY,
1112 Merchants National Bank Bldg., San Francisco, Cal. W. F. Williamson, President. A. G. Dibblee, Secretary. April 29, 1910. $50,000.

*McKITTRICK OIL COMPANY,
1527 Nineteenth St., Bakersfield, Cal. H. A. Jastro, President. C. Brower, Secretary. November 18, 1899. $500,000. Two wells, Kern County.

McKITTRICK PROSPERITY PETROLEUM COMPANY,
227 Sacramento St., San Francisco, Cal. A. R. Lord, President. C. W. Chapman, Secretary. November 20, 1900. $500,000.

*MECCA OIL COMPANY,
Bakersfield, Cal. D. H. McConnell, President. A. D. Henderson, Secretary. April 23, 1901. $450,000. Fourteen wells, Kern County.

*MECCA OIL COMPANY No. 2,
Bakersfield, Cal. D. H. McConnell, President. A. D. Henderson, Secretary. July 9, 1912. $100,000. Seven wells, Kern County.

*MELITA OIL COMPANY,
607 First National Bank Bldg., San Francisco, Cal. Robert Hays Smith, President. A. Whearty, Secretary. December 23, 1915. $20,000. Fifteen wells, Kern County.

MELTON OIL COMPANY,
511 American Bank Bldg., Los Angeles, Cal. Care Paul Nourse. March 12, 1917. $50,000.

*MERCANTILE CRUDE OIL COMPANY,
507 Grant Bldg., San Francisco, Cal. Peter Caubu, President. P. B. Stumpf, Secretary. December 18, 1900. $200,000. Three wells, Fresno County.

MERCED PARAFFINE OIL COMPANY,
Los Banos, Cal. Care A. H. Solan. June 9, 1914. $1,000,000.

MERICOS OIL COMPANY,
524 Auditorium Bldg., Los Angeles, Cal. Burton E. Green, President. Calvin C. Green, Secretary. November 7, 1901. $100,000, Orig.; $10,000, Dec.

MEXICAN ASSOCIATED OIL COMPANY,
232 S. Broadway, Los Angeles, Cal. Care Chas. L. Wilde, Secretary. April 1, 1910. $1,500,000.

MEXICAN PETROLEUM COMPANY,
1015 Security Bldg., Los Angeles, Cal. E. L. Doheny, President. O. D. Bennett, Secretary. December 20, 1900. $10,000,000.

*M. G. & P. OIL COMPANY,
Box 34, Bakersfield, Cal. T. M. Young, Secretary. (Not operating; property leased by company returned to owners.)

MIDAS OIL COMPANY,
409 Hosfield Bldg., Los Angeles, Cal. Care H. P. Cortelyou. June 20, 1917. $20,000.

MIDGET OIL COMPANY,
60 California St., San Francisco, Cal. J. D. Spreckels, Jr., President. W. H. Hannam, Secretary. April 11, 1910. $25,000.

*MIDLAND OIL COMPANY, THE,
1034 Security Bldg., Los Angeles, Cal. T. A. O'Donnell, President. Norman Bridge, Secretary. November 20, 1908. $100,000. Six wells, Kern County.

*MIDLANDS OILFIELDS COMPANY, LTD.,
1034 Security Bldg., Los Angeles, Cal. T. A. O'Donnell, President. Norman Bridge, Secretary. April 15, 1910. $1,000,000. Three wells, Kern County.

MID STATE OIL COMPANY,
Bank of Italy Bldg., Santa Rosa, Cal. Care Ross Campbell. February 15, 1918. $10,000.

MIDWAY BASIN OIL COMPANY,
230 American Bank Bldg., Monrovia, Cal. Augustus G. Stearns, President. Herbert J. Evans, Secretary. April 13, 1910. $500,000.

MIDWAY COLUMBIAN OIL COMPANY, LTD.,
744 Hastings St. W., Vancouver, B. C. William A. Bauer, President. J. W. Bauer, Secretary. June 18, 1912. $500,000. Kern County.

*MIDWAY CONSOLIDATED LIMITED,
Box 141, Fellows, Cal. C. F. Burton, President. A. L. Butcher, Secretary. October 21, 1913. £100,000. Two wells, Kern County.

MIDWAY FIELD OIL COMPANY,
Second floor, Garland Bldg., 740 S. Broadway, Los Angeles, Cal. C. E. Groat, President. Ben R. Meyer, Secretary. August 8, 1910. $1,000,000.

*MIDWAY FIVE OIL COMPANY,
554 I. W. Hellman Bldg., Los Angeles, Cal. Edwin L. Martin, President. March 22, 1910. $1,000,000. Six wells, Kern County.

*MIDWAY GAS COMPANY,
805 Garland Bldg., Los Angeles, Cal. A. E. Peat, Treasurer. Four wells, Kern County.

*MIDWAY NORTHERN OIL COMPANY,
347 Title Insurance Bldg., Los Angeles, Cal. W. S. McGiffert, President. M. M. Miles, Secretary. October 15, 1910. $1,000,000. Two wells, Kern County.

*MIDWAY OIL COMPANY,
Room 603, 310 Sansome St., San Francisco, Cal. James Ogden, President. A. Heyman, Secretary. May 4, 1901. $1,000,000. Twelve wells, Kern County.

MIDWAY OIL COMPANY OF PORTLAND,
30 Concord Bldg., Portland, Ore. A. E. Davis, Secretary. May 4, 1901. $1,000,000.

MIDWAY PACIFIC OIL COMPANY, THE,
1058 S. Flower St., Los Angeles, Cal. Philip L. Wilson, President. P. F. Schumacher, Secretary. April 18, 1910. $2,000,000. Five wells, Kern County.

*MIDWAY PEERLESS OIL COMPANY,
617 Merritt Bldg., Los Angeles, Cal. H. M. Whittier, President. H. L. Westbrook, Secretary. February 28, 1911. $600,000. Twelve wells, Kern County.

*MIDWAY PREMIER OIL COMPANY,
1103 Federal Realty Bldg., Oakland, Cal. A. J. Snyder, President. L. E. Bower, Secretary. March 18, 1910. $1,000,000. Nine wells, Kern County.

*MIDWAY ROYAL PETROLEUM COMPANY,
648 S. Olive St., Los Angeles, Cal. Frank A. Garbutt, President. A. T. Jergins, Secretary. October 13, 1910. $1,000,000. Nine wells, Kern County.

*M. J. AND M. AND M. CONSOLIDATED,
2779 Poplar St., Oakland, Cal. Bernard Ransome, President. S. C. Teal, Secretary. August 22, 1910. $2,000,000. Thirty wells, Kern County. (Property leased to Standard Oil Company.)

MILES, WILLIAM E.,
68 Post St., San Francisco, Cal.

*MILLIE FRANCIS OIL COMPANY,
Box 8, Taft, Cal. T. O. May, Superintendent. Seven wells, Kern County.

MINORU OIL COMPANY,
310 Sansome St., San Francisco, Cal. John Barneson, President. W. J. Dinsmore, Secretary. June 2, 1909. $500,000.

*MIOCENE OIL COMPANY,
Box 159, Maricopa, Cal. P. Welch, President. Jas. P. Sweeney, Secretary. July 5, 1912. $20,000. Two wells, Kern County.

M. K. AND T. OIL COMPANY,
261 First Savings Bank Bldg., Oakland, Cal. George D. Metcalf, President. John B. Metcalf, Secretary. January 15, 1900. $300,000. Fresno County.

*MOCAL OIL COMPANY,
Shale, Kern County, Cal. Chas. Rittersbacher, President. Elmer Rittersbacher, Secretary. June 9, 1911. $300,000. Four wells, Kern County.

*MODELO OIL COMPANY,
300 Crocker Bldg., San Francisco, Cal. A. F. Morrison, President. W. R. Berry, Secretary. April 26, 1898. $250,000. Nine wells, Ventura County.

MOGUL OIL COMPANY,
Visalia, Cal. Care L. C. Branch. L. Shiffert, President. L. C. Branch, Secretary. October 6, 1909. $100,000.

MONARCH OIL COMPANY,
1809 Chester Ave., Bakersfield, Cal. L. V. Olcese, President. J. B. Hewitt, Secretary. February 3, 1900. $100,000.

MONTANA FRESNO OIL COMPANY,
1245 I St., Fresno, Cal. W. M. Wyatt, President. Wm. L. Dunn, Secretary. January 14, 1900. $14,000.

MONTANA-WYOMING OIL COMPANY,
Box 966, Salt Lake City, Utah. William Spry, President. A. B. Carstensen, Secretary. October 1, 1917. $250,000.

MONTEBELLO NUMBER ONE OIL COMPANY,
Room 602, 356 S. Spring St., Los Angeles, Cal. Care Geo. A. Boden. January 4, 1918. $200,000.

*MONTEBELLO OIL COMPANY,
433 California St., San Francisco, Cal. Chas. W. Gardner, President. A. E. Boynton, Secretary. May 5, 1909. $1,000,000. Eighty wells, Ventura County.

*MONTGOMERY, BUELAH J.,
R.F.D. No. 1, Box 39, Bakersfield, Cal.

MORRO BAY OIL COMPANY,
San Luis Obispo, Cal. A. F. Fitzgerald, President. August Vollmer, Secretary. May 16, 1907. $10,000.

*MOUNT DIABLO OIL, MINING AND DEVELOPMENT COMPANY,
517 Central Bldg., Los Angeles, Cal. Jas. Cullingham, President. N. K. Potter, Secretary. February 23, 1900. $500,000. Four wells, Kern County.

M. P. OIL COMPANY,
801 Baker St., Bakersfield, Cal. Arthur S. Crites, President. M. P. Flickinger, Secretary. May 8, 1909. $21,000.

MUNRO OIL COMPANY,
521 W. P. Story Bldg., Los Angeles, Cal. Geo. W. Walker, President. F. V. Gordon, Secretary. April 25, 1912. $50,000.

MURIEL OIL COMPANY,
310 Sansome St., San Francisco, Cal. John Barneson, President. J. Leslie Barneson, Secretary. April 22, 1909. $250,000.

*MURPHY, W. J.,
2112 Truxtun Ave., Bakersfield, Cal. Two wells, Kern County.

MURPHY OIL COMPANY,
Box "M." Whittier, Cal. William H. Murphy, President. J. T. F. Baeyertz, Secretary. August 18, 1904. $2,000,000. Los Angeles County and Orange County.

*MUSCATINE OIL COMPANY,
814 Merchants National Bank Bldg., Los Angeles, Cal. Mira Hershey, President. G. C. Macfarland, Secretary. August 3, 1908. $20,000, Orig.; $300,000, Inc. Four wells, Kern County. (Sold to Mira Hershey, who will operate under name of "Good Hope Wells.")

*MUTUAL OIL COMPANY, THE,
1006 California Bldg., Los Angeles, Cal. G. L. Holton, President. Grace L. Stevens, Secretary. May 11, 1907. $400,000. One well, Ventura County.

*MYRICK, RUTH K. (MRS.),
404-5 International Bank Bldg., Los Angeles, Cal. O. H. Myrick, Agent. Eight wells, Kern County.

NACIREMA OIL COMPANY,
409 Brower Bldg., Bakersfield, Cal. Robt. Law, Jr., President. E. C. Reed, Secretary. September 29, 1909. $50,000. Kern County.

NATIONAL OIL COMPANY,
627 E. Third St., Los Angeles, Cal. H. H. Schwarz, President. B. L. Schwarz, Secretary. June 15, 1915. $10,000.

*NATIONAL PACIFIC OIL COMPANY,
1001 Higgins Bldg., Los Angeles, Cal. John Barneson, President. C. R. Stevens, Secretary. December 6, 1911. $3.500,000. Two wells, Kern County.

NATIONAL PETROLEUM COMPANY,
1003 Higgins Bldg., Los Angeles, Cal. Wm. Walker, President. C. R. Stevens, Secretary. April 24, 1913. $100,000.

NATOMA OIL COMPANY,
510 Crocker Bldg., San Francisco, Cal. W. R. Berry, President. R. A. Morton, Secretary. (Dissolved.)

NATURAL GAS AND PETROLEUM COMPANY,
532 Fifteenth St., Oakland, Cal. C. A. Brown, President. E. R. Arner, Secretary. February 3, 1917. $100,000.

*NETHERLANDS OIL COMPANY,
1910 Mariposa St., Fresno, Cal. W. B. Holland, President. Ben Epstein, Secretary. March 5, 1909. $200,000. Three wells, Fresno County.

*NEVADA COUNTY OIL COMPANY,
820 Union Oil Bldg., Los Angeles, Cal. D. E. Morgan, President. W. B. Robb, Secretary. September 22, 1900. $250,000. Thirteen wells, Kern County.

*NEVADA PETROLEUM COMPANY,
1026 Crocker Bldg., San Francisco, Cal. A. D. Davis, President. G. D. Abbott, Secretary. December 23, 1908. $1,000,000, Orig.; $5,000,000, Inc.

NEW CASTAIC OIL COMPANY,
1525 Brooklyn Ave., Los Angeles, Cal. Geo. D. Alspach, President. Genevieve D. Garner, Secretary. March 18, 1909. $500,000.

*NEW CENTER OIL COMPANY,
Room 637, 58 Sutter St., San Francisco, Cal. D. S. Bachman, President. A. N. Baldwin, Secretary. September 25, 1905. $25,000. Five wells, Kern County.

NEW ENGLAND OIL COMPANY,
119 E. Colorado St., Pasadena, Cal. M. E. Wood, President. MacD. Snowball, Secretary. April 16, 1900. $300,000.

NEW ERA OIL COMPANY,
Southern Title Bldg., San Diego, Cal. Care Sumner & May. September 30, 1916. $100,000.

NEWHALL MOUNTAIN OIL COMPANY,
210 S. Hudson Ave., Pasadena, Cal. L. D. Swartwout, President. S. L. Wallis, Secretary. October 9, 1901. $50,000.

NEW HOPE OIL COMPANY,
729 Mills Bldg., San Francisco, Cal. C. S. Loumeister, Vice-President. W. E. Dennison, Secretary. October 3, 1899. $100,000.

NEWLOVE OIL COMPANY,
1114 Union Oil Bldg., Los Angeles, Cal. W. W. Orcutt, President. John McPeak, Secretary. April 30, 1906. $1.500,000. Santa Barbara County.

NEWMAN, MORRRIS OIL AND LAND COMPANY,
1 Powell St., San Francisco, Cal. W. W. Kaye, President. Chas. J. Newman, Secretary. January 3, 1912. $500,000.

NEW MEXICO OIL COMPANY,
Ventura, Cal. Gus Mulholland, Manager.

*NEW PENNSYLVANIA PETROLEUM COMPANY,
105 N. Broadway, Santa Maria, Cal. A. F. Fugler, President. G. M. Scott, Secretary. August 6, 1904. $500,000. Four Wells, Santa Barbara County.

*NEW SAN FRANCISCO CRUDE OIL COMPANY,
904 I St., Fresno, Cal. H. H. Welsh, Vice President. W. J. O'Neill, Secretary. January 17, 1902. $40,000, Orig.; $150,000, Inc. Two wells, Fresno County.

*NILES LEASE COMPANY,
1034 Security Bldg., Los Angeles, Cal. T. A. O'Donnell, President. Norman Bridge, Secretary. February 17, 1908. $1,000,000. Nine wells, Los Angeles County.

*NORTH AMERICAN OIL CONSOLIDATED,
544 Market St., San Francisco, Cal. Louis Titus, President. C. F. Nance, Secretary. February 3, 1910. $3,000,000. Nineteen wells, Kern County.

NORTH MIDWAY OIL COMPANY,
Box 598, care Roy Jones, Santa Monica, Cal. L. W. Andrews, President. Roy Jones, Secretary. November 8, 1909. $200,000.

OAKBURN OIL COMPANY,
1003 Higgins Bldg., Los Angeles, Cal. J. W. Maddrill, President. C. R. Stevens, Secretary. February 18, 1910. $1,000,000.

*OAKLAND MIDWAY OIL COMPANY,
612 Union Savings Bank Bldg., Oakland, Cal. James P. Taylor, Secretary. June 15, 1910. $500,000. Four wells, Kern County.

OAKLAND OIL COMPANY,
58 Sutter St., San Francisco, Cal. W. T. Sesnon, Vice President. A. J. Samuel, Secretary. September 14, 1899. $20,000.

*OAK RIDGE OIL COMPANY,
433 California St., San Francisco, Cal. Chas. W. Gardner, President. A. E. Boynton, Secretary. January 6, 1911. $5,000,000. Two wells, Ventura County.

*OBISPO OIL COMPANY,
P. O. Box 341, San Luis Obispo, Cal. J. W. Barneberg, President. Francis H. Throop, Secretary. February 25, 1909. $500,000. Two wells, Kern County.

OCCIDENT OIL COMPANY,
1927 Mariposa St., Fresno, Cal. Wm. Helm, President. W. O. Miles, Secretary. May 13, 1899. $32,000.

OCTAVE OIL COMPANY,
1004 Security Bldg., Los Angeles, Cal. Wm. H. Whittier, President. Thos. A. O'Donnell, Secretary. April 11, 1903. $50,000.

OHIO CRUDE OIL COMPANY,
346 Pacific Electric Bldg., Los Angeles, Cal. June 4, 1910. $300,000. Kern County.

*OIL EXPLORATION COMPANY OF CALIFORNIA,
603 Nevada Bank Bldg., San Francisco, Cal. Jos. Errington, President. Jas. P. Sweeney, Secretary. August 8, 1910. $300,000. Five wells, Fresno County.

OILFIELDS SYNDICATE,
901 Insurance Exchange, San Francisco, Cal. A. E. Boynton, President. September 27, 1917. $250,000.

OIL LAND EXPLORATION COMPANY,
514 Humboldt Bank Bldg., San Francisco, Cal. Care H. F. Peart. February 23, 1909. $250,000.

*OJAI OIL COMPANY,
315 Bumiller Bldg., Los Angeles, Cal. F. E. Dunlap, President. W. V. Ambrose, Secretary. June 4, 1900. $750,000. Four wells, Ventura County.

*OJAI VALLEY PETROLEUM COMPANY,
207 Laughlin Bldg., Los Angeles, Cal. S. H. Watson, President. Jas. A. Haskett, Secretary. March 11, 1909. $750,000. Twenty wells, Kern County.

OLD KEYSTONE OIL COMPANY,
1114 Union Oil Bldg., Los Angeles, Cal. Lyman Stewart, President. John McPeak, Secretary. February 15, 1897. $100,000.

OLEMA OIL COMPANY,
824 Mills Bldg., San Francisco, Cal. Oliver Ellsworth, President. M. A. Thomas, Secretary. October 2, 1900. $200,000. Kern County.

OLEUM TERRA COMPANY,
2706 Brighton Ave., Los Angeles, Cal. E. C. Freeman, President. J. G. Todd, Secretary. January 9, 1901. $16,000.

*OLIG CRUDE OIL COMPANY,
2827 La Salle Ave., Los Angeles, Cal. Geo. W. Walker, President. J. H. Purdy, Secretary. September 28, 1904. $500,000. Nine wells, Kern County.

OLIG LAND COMPANY,
2827 La Salle Ave., Los Angeles, Cal. Geo. W. Walker, President. J. H. Purdy, Secretary. February 14, 1908. $50,000.

*OLINDA LAND COMPANY,
702 Equitable Bldg., Los Angeles, Cal. W. H. Bailey, Jr., President. M. Sutherland, Secretary. August 31, 1900. $2,000,000. Nine wells, Orange County.

ON TOP OIL COMPANY,
1611 Las Lunas St., Pasadena, Cal. J. F. Waterman, President-acting. V. L. O'Brien, Secretary. March 29, 1915. $25,000. Kern County.

OPHIR OIL COMPANY,
324 Sansome St., San Francisco, Cal. John Barneson, President. W. J. Dinsmore, Secretary. October 7, 1909. $100,000. Fresno County.

ORANGE OIL COMPANY,
303 Tajo Bldg., Los Angeles, Cal. W. B. Scott, President. W. Astley, Secretary. (Dissolved.)

*ORCUTT OIL COMPANY,
Lompoc, Cal. A. Lehmann, President. J. A. Day, Secretary. December 31, 1907. $300,000. Five wells, Santa Barbara County.

OSAGE FIFTY-EIGHT OIL COMPANY,
1420 Orange Drive, Los Angeles, Cal. Care Chas. Rittersbacher. March 6, 1905. $500,000.

OTAY OIL COMPANY,
902 American National Bank Bldg., San Diego, Cal. E. S. Gilbert, President G. W. Johnston, Secretary. January 3, 1910. $125,000.

*OZARK OIL COMPANY,
P. O. Box 564, Los Angeles, Cal. W. P. James, President. O. H. Burke, Secretary. July 18, 1907. $250,000. Three wells, Fresno County.

OZENA OIL COMPANY,
611 Story Bldg., Los Angeles, Cal. Care Alfred E. Peterson. April 17, 1916. $200,000.

*PACIFIC CRUDE OIL COMPANY,
112 Market St., San Francisco, Cal. G. N. Easton, President. John Lee, Jr., Secretary. May 19, 1911. $750,000. Three wells, Kern County.

*PACIFIC LIGHT AND POWER CORPORATION,
608 Pacific Electric Bldg., Los Angeles, Cal. O. V. Showers, Secretary. Forty wells, Los Angeles County. (Consolidated with Southern California Edison Company.)

*PACIFIC MIDWAY OIL COMPANY,
822 Mills Bldg., San Francisco, Cal. B. S. Noyes, President. Benjamin Romaine, Secretary. January 31, 1910. $250,000. Four wells, Kern County.

PACIFIC OILFIELDS LIMITED,
350 California St., San Francisco, Cal. A. B. Williamson, President. F. W. Bishop, Secretary. December 23, 1907. £250,000. San Luis Obispo County and Santa Barbara County.

*PACIFIC STATES PETROLEUM COMPANY,
P. O. Box "B2," Coalinga, Cal. G. W. Richard, President. L. L. Richard, Secretary. April 23, 1909. $300,000. One well, Fresno County.

PALLADIUM INVESTMENT COMPANY,
648 S. Olive St., Los Angeles, Cal. Frank A. Garbutt, President. A. T. Jergins, Secretary. (Dissolved.)

PALMER ANNEX OIL COMPANY,
1000 Title Insurance Bldg., Los Angeles, Cal. Shirley E. Meserve, President. J. E. Wallis, Secretary. June 5, 1909. $2,000,000.

*PALMER UNION OIL COMPANY,
Box 202, Santa Barbara, Cal. J. M. Williamson, President. M. F. Lewis, Secretary. December 5, 1910. $10,000,000. Five wells, Kern County; 6 wells, Santa Barbara County.

PAN AMERICAN PETROLEUM COMPANY,
1015 Security Bldg., Los Angeles, Cal. E. L. Doheny, President. O. D. Bennett, Secretary. September 11, 1916. $1,000,000. Ventura County.

PAN AMERICAN PETROLEUM INVESTMENT CORPORATION,
1015 Security Bldg., Los Angeles, Cal. E. L. Doheny, President. O. D. Bennett, Secretary. October 30, 1916. $5,000,000.

*PANTHEON OIL COMPANY,
55 New Montgomery St., San Francisco, Cal. R. P. Schwerin, President. P. G. Williams, Secretary. February 28, 1910. $750,000. Two wells, Fresno County.

*PARAFFINE OIL COMPANY,
Box 556, Room 416, Producers Bank Bldg., Bakersfield, Cal. H. F. Condict, President. T. H. Minor, Secretary. January 24, 1901. $300,000. Five wells, Kern County.

PARAFFIN OIL PRODUCTS COMPANY,
732 Van Nuys Bldg., Los Angeles, Cal. Care E. Earl Crandall, Agent. July 26, 1917. $200,000.

PARAISO OIL COMPANY,
Syndicate Bldg., Oakland, Cal. J. E. Ennis, President. J. N. Turner, Secretary. September 18, 1914. $200,000.

*PARKER, M. C.,
1134 W. Eighteenth St., Los Angeles, Cal. Twelve wells, Kern County.

PARKER OIL COMPANY,
208 S. Van Ness Ave., Los Angeles, Cal. Nettie A. Parker, President. M. F. Klingaman, Secretary. May 16, 1900. $250,000.

*PATRICIA OIL COMPANY.
P. O. Box 441, Bakersfield, Cal. F. A. Carrick, President. A. C. Tupman, Secretary. May 21, 1910. $250,000. Seventeen wells, Kern County.

PAUSON OIL COMPANY,
180 Sutter St., San Francisco, Cal. S. B. Pauson, President. J. W. Pauson, Secretary. November 5, 1904. $100,000.

P. C. L. OIL COMPANY,
111 N. Church St., Visalia, Cal. Geo. T. Parr, President. John Cutler, Secretary. November 26, 1909. $100,000.

*PEERLESS OIL COMPANY,
824 Crocker Bldg., San Francisco, Cal. T. C. Petersen, President. H. C. Park, Secretary. October 9, 1899. $1,000,000. Sixty-two wells, Kern County.

*PENN COALINGA PETROLEUM COMPANY,
607 First National Bank Bldg., San Francisco, Cal. J. L. Boyner, President. Robt. Hays Smith, Secretary. June 26, 1905. $350,000. Ten wells, Fresno County.

PENTLAND UNION PETROLEUM COMPANY,
401 Union Oil Bldg., Los Angeles, Cal. Edward Fox, President. F. C. Lamb, Secretary. June 29, 1912. $15,000.

PERSEUS OIL COMPANY,
207 S. Broadway, Los Angeles, Cal. T. Dudley, President. W. H. Dowsing, Secretary. March 7, 1901. $200,000. Kern County.

*PETROL COMPANY, THE,
Santa Susana, Cal. W. S. Baylis, Secretary. Ten wells, Ventura County.

*PETROLEUM COMPANY, THE,
407-8 Consolidated Realty Bldg., Los Angeles, Cal. M. H. Mosier, President. Geo. H. Johnson, Secretary. September 30, 1910. $250,000. Four wells, Orange County.

*PETROLEUM DEVELOPMENT COMPANY,
756 Kerckhoff Bldg., Los Angeles, Cal. E. O. Faulkner, President. G. Holterhoff, Jr., Secretary. May 26, 1899. $125,000. Seventy wells, Orange County; 111 wells, Kern County.

***PETROLEUM MIDWAY COMPANY, LTD.,**
1034 Security Bldg., Los Angeles, Cal. T. A. O'Donnell, President. Norman Bridge, Secretary. February 15, 1915. $1,000,000. Nine wells, Kern County.

PETROLEUM NORTH MIDWAY COMPANY,
1023 Crocker Bldg., San Francisco, Cal. F. W. Bradley, President. S. A. Guiberson, Jr., Secretary. Kern County. (Dissolved.)

PETROLIA OIL COMPANY.
Tulare and J Sts., Tulare, Cal. A. W. Wheeler, President. W. A. Higgins, Secretary. June 29, 1899. $50,000.

PHOENIX OIL COMPANY,
P. O. Box 416, Hanford, Cal. P. McRae, President. W. R. McQuiddy, Secretary. November 28, 1898. $100,000.

PICO OIL COMPANY.
303 Tajo Bldg., Los Angeles, Cal. W. B. Scott, President. W. Astley, Secretary. (Dissolved.)

***PIEDMONT OIL COMPANY,**
1206 Broadway, Oakland, Cal. E. A. Heron, President. H. L. Breed, Secretary. December 17, 1900. $4,000. Six wells, Kern County. (Property sold; now operated by A. S. Crites.)

PIERPONT OIL COMPANY,
149 N. Los Angeles St., Los Angeles, Cal. Wm. Hardee, President. F. W. Black, Secretary. March 29, 1909. $500,000. Twelve wells, Kern County.

***PILOT OIL COMPANY,**
607 First National Bank Bldg., San Francisco, Cal. H. J. Doulton, President. G. A. Scott, Secretary. May 9, 1908. $100,000, Orig.; $200,000, Inc. Five wells, Fresno County.

***PINAL DOME OIL COMPANY,**
Santa Maria, Cal. J. F. Goodwin, President. Geo. P. Merritt, Secretary. June 21, 1912. $360,000. Sixty-eight wells, Santa Barbara County; 10 wells, Kern County. (Property purchased by Union Oil Co.)

PINE RIDGE PETROLEUM COMPANY,
Amy Block, Coalinga, Cal. Care Henry S. Richmond. May 8, 1917. $50,000.

PIONEER MIDWAY OIL COMPANY,
411 Montgomery St., San Francisco, Cal. I. Strasburger, President. A. E. Cole, Secretary. August 17, 1907. $1,000,000.

***PIONEER MIDWAY OIL COMPANY CONSOLIDATED,**
55 New Montgomery St., San Francisco, Cal. Wm. Sproule, President. P. G. Williams, Secretary. June 13, 1910. $2,000,000. Six wells, Kern County.

PIRU OIL COMPANY,
300 Crocker Bldg., San Francisco, Cal. W. Gregg, Jr., President. W. R. Berry, Secretary. January 21, 1887. $100,000.

PITCHER & GARBUTT OIL COMPANY,
648 S. Olive St. Los Angeles, Cal. Frank A. Garbutt President. Samuel C. Hall, Secretary. (Dissolved.)

PITTSBURGH BELRIDGE OIL COMPANY,
P. O. Box 10, McKittrick, Cal. W. S. Kuhn President. Wendell S. Kuhn, Secretary. April 12, 1912. $250,000. Kern County.

PITTSBURGH PACIFIC OIL COMPANY,
410 Brower Bldg., Bakersfield, Cal. Care R. A. Broomfield. June 4, 1914. $1,000,000.

PLACENTIA OIL COMPANY,
522 Security Bldg., Los Angeles, Cal. S. E. Brobst, Secretary. November 4, 1914. $100,000. Orange County. (Dissolved.)

PLACERITA OIL COMPANY,
119 E. Colorado St., Pasadena, Cal. F. C. Melton, President. Leo G. MacLaughlin, Secretary. (Dissolved.)

PLEASANT VALLEY OIL COMPANY, LTD.,
Care Universal Oil Company, Lost Hills, Cal. T. A. Crumpton, President. I. M. Conkey, Secretary. August 16, 1911. $15,000.

PLEYTO CONSOLIDATED OIL COMPANY,
333 Kearny St., San Francisco, Cal. C. W. Jackson, President. J. C. Currier, Secretary. April 15, 1912. $400,000.

PORTOLA OIL COMPANY, THE,
798 Minnesota St., San Francisco, Cal. Care Geo. P. Moore, Agent. June 11, 1917. (No par value.)

POSO CREEK OIL COMPANY,
Care S. L. Mack, Southern Hotel, Bakersfield, Cal. S. P. Wible, President. S. L. Mack, Secretary. November 22, 1899. $100,000.

POSTON OIL COMPANY,
Box 354, Santa Clara, Cal. J. C. Sutherland, President. F. A. Birge, Secretary. October 29, 1899. $30,000.

***POTTER OIL COMPANY OF CALIFORNIA,**
410 Brower Bldg., Bakersfield, Cal. Robt. Law, Jr., President. J. H. Healey, Secretary. April 26, 1915. $500,000. Twenty-four wells, Kern County.

***PRAIRIE OIL COMPANY,**
Care Thos. M. Diviny, 244 Kearny St., San Francisco, Cal. Alex Wark, President. T. V. Daub, Secretary. April 14, 1916. $50,000. Two wells, Kern County.

PREMIER ANTIOCH OIL COMPANY,
714 Tenth St., Oakland, Cal. S. B. Reynolds, President. J. H. Somers, Secretary. August 19, 1911. $200,000.

***PREMIER OIL COMPANY,**
579 H. W. Hellman Bldg., Los Angeles, Cal. T. Spellacy, President. W. M. Wallace, Secretary. September 5, 1907. $1,000,000. Nine wells, Fresno County.

***PRICEWELL OIL COMPANY,**
Care C. E. Price Wilcox Bldg., Los Angeles, Cal. A. D. Elwell, President. C. E. Price, Secretary. March 20, 1909. $50,000. Eight wells, Kern County.

PRINCETON OIL COMPANY,
208 Brower Bldg., Bakersfield, Cal. H. A. Jastro, President. C. A. Barlow, Secretary. January 7, 1913. $50,000. Kern County.

PRODUCERS OIL COMPANY, GUARANTEED,
1945 Tulare St., Fresno. Cal. B. F. Shepherd, Jr., President. N. G. Cochrane, Secretary. October 25, 1899. $500,000. Kern County.

*PROVIDENTIAL OIL COMPANY,
320 Timken Bldg., San Diego, Cal. F. E. Wisecup, President. J. A. Smith, Secretary. October 5, 1914. $1,000,000. Two wells, Orange County.

PROVIDENT OIL MINING COMPANY,
637 Monadnock Bldg., San Francisco, Cal. Dr. A. McFadyen, President. J. C. Cullen, Secretary. November 26, 1900. $300,000. Kern County.

PUENTE OIL COMPANY,
1005 Central Bldg., Los Angeles, Cal. Wm. R. Rowland, President. W. Astley, Secretary. January 22, 1892. $250,000.

PURE OIL COMPANY OF SANTA PAULA,
512 S. Broadway, Los Angeles, Cal. J. W. Young, President. Philip Forve, Secretary. June 4, 1900. $300,000.

PURISSIMA HILLS OIL COMPANY,
349 Rialto Bldg., San Francisco, Cal. Howard A. Broughton, President. James Casey, Secretary. October 31, 1908. $1,000,000.

PURITAN OIL COMPANY,
504 I. W. Hellman Bldg., Los Angeles, Cal. W. J. Wallace, President. Harry J. Bauer, Secretary. March 22, 1916. $100,000.

*PYRAMID OIL COMPANY,
715 Phelan Bldg., San Francisco, Cal. G. S. Johnson, President. Otto B. Johnson, Secretary. October 7, 1909. $1,000,000. Thirteen wells, Ventura County; 5 wells, Kern County.

*QUEEN OIL COMPANY,
Care First National Bank, Los Angeles, Cal. W. N. Hamaker, Secretary. Three wells. Fresno County.

QUINTUPLE OIL COMPANY,
338 Consolidated Realty Bldg., Los Angeles, Cal. R. J. Gaffney, President. A. E. Hurley, Secretary. July 30, 1914. $100,000. Two wells, Orange County.

RADIUM OIL COMPANY,
410 Montgomery St., San Francisco, Cal. Charles Sutro, President. Sidney L. Schwartz, Secretary. April 29, 1904. $250,000.

*RANCHO LA BREA OIL COMPANY,
Merchants National Bank Bldg., Los Angeles, Cal. G. Allan Hancock, Executor. Fifty-seven wells, Los Angeles County.

RAMBLER OIL COMPANY,
619 Union Oil Bldg., Los Angeles, Cal. M. V. McQuigg, President. A. J. Wallace, Secretary. June 17, 1908. $50,000.

*RECORD OIL COMPANY,
435 Mills Bldg., San Francisco, Cal. H. H. Haub, President. W. J. Clark, Secretary. March 3, 1905. $200.000. Eight wells, Fresno County.

RECOVERY OIL COMPANY,
510 Crocker Bldg., San Francisco, Cal. Geo. T. Cameron, President. R. A. Morton, Secretary. December, 1910. $1,000,000. Fresno County.

RECRUIT OIL COMPANY,
55 New Montgomery St., San Francisco, Cal. Wm. Sproule. President. P. G. Williams, Secretary. May 4, 1903. $1,000,000. Santa Barbara County.

RED MAN PETROLEUM COMPANY,
3096 California St., San Francisco, Cal. A. A. Cohn, President. W. I. Sterett, Secretary. October 27, 1911. $300,000.

REFINING AND PRODUCING OIL COMPANY,
354 Pine St., San Francisco, Cal. T. N. Barnsdall, President. R. A. Broomfield, Secretary. May 4, 1911. $2,250,000.

RED STAR PETROLEUM COMPANY,
1034 Security Bldg., Los Angeles, Cal. T. A. O'Donnell, President. W. D. Stewart, Secretary. June 8, 1917. $500,000.

REGAL OIL COMPANY,
226-227 Security Bldg., Los Angeles, Cal. E. E. Dunlap, President. G. C. Dennis. Secretary. September 12, 1908. $100,000. Kern County.

REPUBLIC OIL COMPANY,
1118 Hearst Bldg., San Francisco, Cal. S. A. Guiberson, Jr., President. B. H. Henderson, Secretary. February 2, 1910. $6,000.

RESULT OIL COMPANY,
1118 Kohn Building, San Francisco, Cal. P. E. Bowles, President. F. W. McNear, Secretary. March 6 1908. $25,000.

*REVENUE OIL COMPANY,
409 Citizens Savings Bank Bldg., Pasadena, Cal. R. H. Pinney, President. A. K. Nash, Secretary. March 17, 1900. $200,000. Eleven wells, Kern County.

*REWARD OIL COMPANY,
1118 Kohl Bldg., San Francisco, Cal. P. E. Bowles, President. F. W. McNear. Secretary. March 9, 1901. $100,000. Forty-two wells, Kern County.

RHOADS & SCHMITT,
Alma, Cal. Wm. Rhoads, Manager. Santa Clara County.

*RICE RANCH OIL COMPANY,
710 Merchants National Bank Bldg., Los Angeles, Cal. C. J. Kubach, President. E. A. Rang, Secretary. March 14, 1904. $300,000. Thirteen wells, Santa Barbara County.

RICHFIELD OIL COMPANY,
933 Van Nuys Bldg., Los Angeles, Cal. T. A. Winter, President. G. J. Syminton, Secretary. November 29, 1911. $150,000.

RIO BRAVO OIL COMPANY,
Care Wm. Palmtag, Hollister, Cal. Geo. D. Clark, President. Walker C. Graves, Secretary. February 14, 1900. $100,000.

RIO HONDO PETROLEUM COMPANY,
1117 Title Insurance Bldg., Los Angeles, Cal. Care Goodwin & Morgrage. November 1, 1917. $300,000.

ROANOKE OIL COMPANY,
Room 3, Farmers National Bank, Fresno, Cal. Care G. L. Warlow, Secretary. December 24, 1900. $100,000.

***ROCK OIL COMPANY,**
1007 Washington Bldg., Los Angeles, Cal. L. C. Torrance, President. Nichols Milbank, Secretary. April 7, 1910. $125,000. Eight wells, Kern County.

ROSE OIL COMPANY,
600 S. Broadway, Los Angeles, Cal. Frederick J. Mullen, President. James B. Sullivan, Secretary. July 6, 1903. $200,000.

ROSE OIL COMPANY,
Sespe, Cal. C. E. Ingalls, President. Ventura County.

ROYAL PETROLEUM COMPANY, LTD.,
720 Story Bldg., Los Angeles, Cal. Care Murphey & Gray. June 29, 1917. $9,600.

R. T. OIL COMPANY,
Care G. S. Thurman, Madera, Cal. W. B. Thurman, President. G. S. Thurman, Secretary. September 19, 1910. $150,000.

***RUBY OIL COMPANY, THE,**
1008 Security Bldg., Los Angeles, Cal. J. M. Danziger, President. George L. Reynolds, Secretary. February 13, 1908. $40,000. Ten wells, Kern County.

***SAFE OIL COMPANY,**
208 Brower Bldg., Bakersfield, Cal. C. A. Barlow, President. W. H. Hill, Secretary. March 1, 1907. $100,000. Four wells, Kern County.

SAFETY OIL COMPANY,
Care G. E. Brinckerhoff, Delger Bldg., Fourteenth and Broadway, Oakland, Cal. G. Erwin Brinckerhoff, President. M. V. Cooley, Secretary. March 8, 1901. $300,000, Orig.: $17,500, Dec.

***SALT LAKE OIL COMPANY OF CALIFORNIA,**
55 New Montgomery St., San Francisco, Cal. Wm. Sproule, President. P. G. Williams, Secretary. November 27, 1903. $500,000. One hundred five wells, Los Angeles, County.

***SALTMARSH CANON OIL COMPANY,**
P. O. Box 44, Santa Paula, Cal. A. M. Dunham, President. F. H. Dunham, Secretary. September 24, 1902. $20,000, Orig.: $50,000, Inc. Five wells, Ventura County.

***SALVIA OIL COMPANY,**
1004 Security Bldg., Los Angeles, Cal. Thos. A. O'Donnell, President. Ellis T. Yarnell, Secretary. November 3, 1915. $10,000. Fourteen wells, Fresno County.

SAMSONIAN OIL COMPANY,
First National Bank Bldg., Oakland, Cal. Care H. B. Griffith. March 19, 1917. $25,000.

SAN ANTONIO OIL AND LAND COMPANY,
348 Hayes St., San Francisco, Cal. James R. Little, President. C. W. Jackson, Secretary. March 19, 1900. $100,000.

SAN BERNARDINO VALLEY OIL COMPANY,
San Bernardino, Cal. Care A. E. Perris. December 2, 1912. $25,000.

SAN CARLOS OIL COMPANY,
200 McAllister St., San Francisco, Cal. February 19, 1892. $1,000,000, Orig.; $100,000, Dec.

SAN DIEGO AND IMPERIAL VALLEY OIL COMPANY,
American Bank Bldg., San Diego, Cal. Care Bernard & Macomber. March 21, 1917. $25,000.

***SAN DIEGO CONSOLIDATED OIL COMPANY,**
Owl Drug Bldg., San Diego, Cal. P. M. Johnson, President. George H. Hughes, Secretary. May 3, 1915. $500,000. Two wells, Orange County.

SAN DIEGO OIL COMPANY,
Care John F. McVean, 2637 Logan Ave., San Diego, Cal. John F. McVean, President. H. C. Barnes, Secretary. October 28, 1916. $50,000.

***SAN FRANCISCO AND McKITTRICK OIL COMPANY,**
607 Monadnock Bldg., San Francisco, Cal. H. U. Maxfield, President. Walter C. Beatie, Secretary. December 11, 1899. $500,000. Seventeen wells, Kern County.

SAN FRANCISCO AND WYOMING OIL COMPANY,
67 Buena Vista Terrace, San Francisco, Cal. F. J. Baird, President. Wm. J. Drew, Secretary. August 15, 1913. $200,000.

***SAN FRANCISCO MIDWAY OIL COMPANY,**
660 Market St., San Francisco, Cal. G. F. Lyon, President. W. S. Oliver, Secretary. March 25, 1910. $500,000. One well, Kern County.

SAN FRANCISCO OSAGE OIL AND GAS COMPANY,
617 Merritt Bldg., Los Angeles, Cal. W. M. Graham, President. F. B. Sutton, Secretary. (Dissolved.)

SAN GABRIEL PETROLEUM COMPANY,
1117 Title Insurance Bldg., Los Angeles, Cal. Care Goodwin & Morgrage. June 28, 1917. $100,000.

SAN JUAN OIL COMPANY,
1910 Mariposa St., Fresno, Cal. Ben Epstein, Secretary. March 5, 1909. $250,000. Fresno County.

***SANTA CLARA OIL AND DEVELOPMENT COMPANY,**
719 Story Bldg., Los Angeles, Cal. L. C. Throop, President. C. A. Nelson, Secretary. February 9, 1912. $1,000,000. One well, Ventura County.

SANTA MARIA CRUDE OIL COMPANY,
316 Bumiller Bldg., Los Angeles, Cal. W. V. Ambrose, President. Chas. F. Off, Secretary. December 29, 1906. $500,000.

SANTA MARIA ENTERPRISE OIL COMPANY,
613 Hibernian Bank, Los Angeles, Cal. G. E. Bittinger, President. E. L. Brock, Secretary. December 15, 1909. $400,000.

***SANTA MARIA OILFIELDS, INC.,**
Box 638, Santa Maria, Cal. Carroll W. Gates, President. Jay Spence, Secretary. March 14, 1916. $2,250,000. Four wells, Santa Barbara County.

***SANTA PAULA OIL COMPANY,**
433 California St., San Francisco, Cal. H. R. Edwards, President. A. E. Boynton, Secretary. October 13, 1916. $100,000. One well, Santa Barbara County.

SANTA PAULA Y SATICOY OIL COMPANY,
319 Kohl Bldg., San Francisco, Cal. William Whitney, President. A. C. Hellman, Secretary. March 28, 1903. $100,000.

SANTA SUSANA OIL CORPORATION,
1101 Hollingsworth Bldg., I. H. Lehman, President. Herbert M. De Lanoie, Secretary. Los Angeles, Cal. November 30, 1917. $3,000,000.

***SANTA SUSANA SYNDICATE,**
1101 Hollingsworth Bldg., Los Angeles, Cal. Dr. A. Hirschi, President. Eleven wells, Ventura County. (Property taken over by Santa Susana Oil Corporation.)

***SAUER DOUGH OIL COMPANY,**
510 Crocker Bldg., San Francisco, Cal. Geo. T. Cameron, President. R. A. Morton, Secretary. January 7, 1901. $50,000. Fresno County.

***SCARAB OIL COMPANY,**
344 Fifth St., Oxnard, Cal. W. L. Dunn, President. H. R. Staples, Secretary. March 1, 1909. $100,000. Two wells, Ventura County. (Property of Union Oil Company; pumped by Scarab Oil Company on royalty.)

SEABOARD OIL AND TRANSIT COMPANY,
1101 Story Bldg., Los Angeles, Cal. C. L. Flack, President. C. A. Goodrich, Secretary. December 28, 1911. $1,000,000.

***SEASIDE OIL COMPANY,**
Summerland, Cal. H. J. Hart, President. L. C. Cook, Secretary. February 24, 1898. $200,000. Orig.; $10,000 Dec. Seven wells, Santa Barbara County.

***SECTION FIVE OIL COMPANY,**
255 Holbrook Bldg., San Francisco, Cal. F. L. Lezinsky, President. S. G. O. King, Secretary. December 3, 1900. $75,000, Orig.; $150,000, Inc. Eight wells, Kern County.

SECTION ONE OIL COMPANY,
502 Balboa Bldg., San Francisco, Cal. T. A. O'Donnell, President. O. G. Myers, Secretary. August 14, 1907. $10,000.

***SECTION SEVEN OIL COMPANY,**
607 First National Bank Bldg., San Francisco, Cal. W. J. Boiner, President. H. E. Sherbley, Secretary. June 26, 1905. $300,000. Six wells, Fresno County.

SECTION THREE OIL COMPANY,
Care G. S. Thurman, Madera, Cal. W. B. Thurman, President. G. S. Thurman, Secretary. February 23, 1911. $150,000.

SECTION TWELVE OIL COMPANY,
Care Jordan & Jordan, Bakersfield, Cal. April 4, 1911. $50,000.

***SECTION TWENTY-FIVE OIL COMPANY,**
208 Brower Bldg., Bakersfield, Cal. T. E. Sullivan, President. C. A. Barlow, Secretary. September 28, 1903. $40,000. Thirty-two wells, Kern County.

***SECURITY DEVELOPMENT COMPANY,**
P. O. Box 813, Bakersfield, Cal. E. D. Burge, President. C. H. Franey, Secretary. April 29, 1913. $50,000. Nine wells, Kern County.

SECURITY OIL COMPANY,
1004 Title Insurance Bldg., Los Angeles, Cal. Care E. A. Hawkins. October 19, 1916. $200,000. Kern County.

***SENECA OIL COMPANY,**
1133 Divisadero St., Fresno, Cal. Geo. L. Warlow, President. W. T. Knowles, Secretary. April 20, 1908. $250,000. Five wells, Fresno County.

***SESNON OIL COMPANY,**
58 Sutter St., San Francisco, Cal. W. T. Sesnon, President. G. W. Fanning, Secretary. February 17, 1908. $100,000. Fifteen wells, Kern County.

SHANDON OIL COMPANY,
P. O. Box 400, Caldwell, N. J. Alexander Dallas, President. P. Beaton, Secretary. February 19, 1913. $750,000. Fresno County.

SHAW RANCH OIL COMPANY,
Box 638, Santa Maria, Cal. Oliver C. Edwards, President. Jay Spence, Secretary. September 18, 1912. $2,000,000. Santa Barbara County.

***SHAWMUT OIL COMPANY,**
697 First National Bank Bldg., San Francisco, Cal. Allen T. Borst, Secretary. Three wells, Fresno County. (Dissolved.)

SHEAR PETROLEUM COMPANY,
2827 La Salle Ave., Los Angeles, Cal. H. H. Argue, President. Ellen A. Stoppard, Secretary. January 3, 1910. $100,000. Seven wells, Kern County. (Property purchased by Wesco Petroleum Company.)

***SHELL COMPANY OF CALIFORNIA,**
343 Sansome St., San Francisco, Cal. W. Meischke-Smith, President. R. A. Lewin, Secretary. July 30, 1915. $45,000,000. One hundred sixty-nine wells, Fresno County.

SHIRLEY OIL COMPANY,
421 N. Main St., Santa Ana, Cal. John W. Shirley, President. J. G. Quick, Secretary. January 7, 1903. $10,000.

SHREEVES OIL COMPANY, THE,
55 New Montgomery St., San Francisco, Cal. Wm. Sproule, President. P. G. Williams, Secretary. July 28, 1906. $200,000.

SIBYL OIL COMPANY,
1003 Higgins Bldg., Los Angeles, Cal. J. W. Maddrill, President. C. R. Stevens, Secretary. October 11, 1909. $50,000. Kern County.

SILVER TIP OIL COMPANY,
305 Fifth St., Coalinga Cal. February 25, 1909. $750.

SIXTEEN OIL COMPANY,
Room 504, 411 S. Main St., Los Angeles, Cal. February 15, 1917. $100,000.

*SLOCUM, THOS. A.,
543 Bradbury Bldg., Los Angeles, Cal. Twelve wells, Ventura County.

*SNOOK, WALTER,
Maricopa, Cal. Kern County.

SOUTH COAST OIL COMPANY,
349 Rialto Bldg., San Francisco, Cal. James Casey, President. L. E. Gardner, Secretary. July 10, 1913. $1,000,000.

SOUTHEASTERN LIMITED OIL COMPANY,
Room 637, 58 Sutter St., San Francisco, Cal. Louis Nathan, President. Chas. G. Wilcox, Secretary. September 30, 1908. $500,000.

SOUTHERN CALIFORNIA EDISON COMPANY,
120 East Fourth St., Los Angeles, Cal. Los Angeles County.

*SOUTHERN CALIFORNIA GAS COMPANY,
805 Garland Bldg., Los Angeles, Cal. A. E. Peat, Treasurer and Comptroller. Five wells, Kern County.

SOUTHERN CALIFORNIA OIL SYNDICATE, LTD.,
Bank of Lompoc Bldg., Lompoc, Cal. Magnus Newvat, President. Matthew H. Adams, Secretary. April 23, 1907. £25,000.

SOUTHERN PACIFIC COMPANY,
65 Market St., San Francisco, Cal. Wm. Sproule, President. A. D'Heur, Manager Fuel Oil Department. One hundred thirty-nine wells, Fresno County; 446 wells, Kern County.

SOUTHERN PETROLEUM COMPANY OF CALIFORNIA, THE,
1113 Hibernian Bldg., Los Angeles, Cal. Care Lyle W. Rucker. January 7, 1918. $1,000,000.

SOUTH MIDWAY OIL COMPANY,
410 Chamber of Commerce Bldg., Los Angeles, Cal. Julius Fried, President. W. W. Worthing, Secretary. April 15, 1910. $1,000,000.

SOUTH MOUNTAIN OIL COMPANY,
435 Security Bldg., Los Angeles, Cal. R. Mansard, President. A. L. Jamison, Secretary. October 20, 1913. $300,000.

*SOUTH PACIFIC OIL COMPANY,
637 Consolidated Realty Bldg., Los Angeles, Cal. A. I. Smith, Manager. Eleven wells, Ventura County.

*SOVEREIGN OIL COMPANY,
585 Market St., San Francisco, Cal. William Ellery, President. J. W. Ellery, Secretary. October 15, 1900. $500,000. Ten wells, Kern County.

*SPINKS CRUDE OIL COMPANY,
P. O. Box 598, Monrovia, Cal. Wm. A. Spinks, President. Walter F. Dunn, Secretary. November 3, 1909. $200,000. Seven wells, Fresno County.

S. P. PLACER MINING COMPANY,
1511 Eighteenth St., Bakersfield, Cal. M. A. Lindberg, President. Fred Gunther, Secretary. September 8, 1899. $200,000.

*SPRECKELS OIL COMPANY,
60 California St., San Francisco, Cal. J. D. Spreckels, Jr., President. G. B. Waterman, Secretary. November 1, 1911. $200,000. Four wells, Kern County.

SQUAW FLAT OIL COMPANY,
401 Union Oil Bldg., Los Angeles, Cal. A. J. Aber, President. B. M. Howe, Secretary. August 11, 1910. $200,000.

*STANDARD OIL COMPANY,
Standard Oil Bldg., San Francisco, Cal. W. S. Rheem, President. H. M. Storey, Secretary. September 10, 1879. $100,000,000. Three hundred thirty wells, Kern County; 105 wells, Fresno County; 109 wells, Los Angeles County; 63 wells, Orange County.

*STATE CONSOLIDATED OIL COMPANY,
912 Baker-Detwiler Bldg., Los Angeles, Cal. E. J. Miley, President. A. M. Buley, Secretary. March 3, 1911. $1,250,000. Thirty-one wells, Kern County; 1 well, Ventura County.

STATE OIL COMPANY OF CALIFORNIA,
310 Sansome St., San Francisco, Cal. John Barneson, President. J. Leslie Barneson, Secretary. February 15, 1910. $200,000.

*STAUFFER OIL COMPANY,
624 California St., San Francisco, Cal. C. de Guigne, President. C. Jantzen, Secretary. May 19, 1909. $100,000. Six wells, Kern County.

STEPHENS DRILLING ACCOUNT,
Merchants National Bank Bldg., Los Angeles, Cal. Moye W. Stephens, Manager. Los Angeles County.

*STERLING OIL AND DEVELOPMENT COMPANY,
55 New Montgomery St., San Francisco, Cal. R. P. Schwerin, President. P. G. Williams, Secretary. October 30, 1899. $250,000. Forty-one wells, Kern County.

*ST. HELENS PETROLEUM COMPANY, LTD., The,
1117 Investment Bldg., Los Angeles, Cal. H. H. Haldin, Chairman. R. H. Young, Secretary. H. W. Orwig, Los Angeles Secretary. May 10, 1913. $1,200,000. Eighteen wells, Kern County; 14 wells, Orange County.

*ST. LAWRENCE OIL COMPANY,
411 Montgomery St., San Francisco, Cal. I. Strassburger, President. A. E. Cole, Secretary. April 14, 1908. $100,000. Seven wells, Kern County.

*STOCKTON MIDWAY OIL COMPANY,
309 E. Main St., Stockton, Cal. Geo. F. Hudson, President. C. F. Campbell, Secretary. December 8, 1910. $1,000,000. Five wells, Kern County.

*ST. PAUL CONSOLIDATED OIL COMPANY,
1133 Divisadero St., Fresno, Cal. Geo. L. Warlow, President. W. T. Knowles, Secretary. September 24, 1910. $600,000. Seven wells, Fresno County.

ST. PAUL-FRESNO OIL COMPANY,
1133 Divisadero St., Fresno, Cal. Geo. L. Warlow, President. W. T. Knowles, Secretary. June 5, 1903. $250,000.

*STRONG OIL COMPANY,
1015 Marsh-Strong Bldg., Los Angeles, Cal. Frank P. Strong (one-fourth owner). Four wells, Fresno County. (Copartnership.)

STURGEON OIL COMPANY,
Care J. A. Turner, Santa Ana, Cal. J. A. Turner, President. I. D. Mills, Secretary. January 11, 1901. $300,000, Orig.; $50,000, Dec. Kern County.

SUBMARINE OIL COMPANY,
Santa Barbara, Cal. Care Santa Barbara Abstract Company. August 25, 1917. $25,000.

*SUCCESSUS OIL COMPANY,
1526-32 Twentieth St., Bakersfield, Cal. Louis V. Olcese, President. Gus Schamblin, Secretary. October 6, 1911. $150,000. One well, Kern County.

SUDDEN & EMSLIE,
Care R. C. Sudden, Ventura, Cal.

SUDDEN OIL COMPANY,
Lompoc, Cal. T. F. Fox, President. John C. Lind, Secretary. March 5, 1910. $300,000.

SULPHUR MOUNTAIN PETROLEUM COMPANY,
Fullerton Cal. Care Wm. Starbuck. July 13, 1900. $800,000.

SUNBEAM OIL COMPANY,
724 Trust and Savings Bldg., Los Angeles, Cal. R. B. Blodget, President. Nichols Milbank, Secretary. July 17, 1916. $100,000. Kern County.

SUNCREST OIL COMPANY,
617 Merritt Bldg., Los Angeles, Cal. Burton E. Green, President. F. B. Sutton, Secretary. September 5, 1916. $50,000.

SUNPARK OIL COMPANY,
617 Merritt Bldg., Eighth and Broadway, Los Angeles, Cal. Burton E. Green, President. F. B. Sutton, Secretary. December 19, 1910. $100,000.

SUNSET EXTENSION OIL COMPANY,
200 N. Broadway, Los Angeles, Cal. Harry M. Wier, President. Geo. E. Mills, Secretary. May 23, 1910. $300,000.

*SUNSET MONARCH OIL COMPANY,
60 California St., Los Angeles, Cal. G. P. Ayers, President. Geo. A. Douglass, Secretary. December 10, 1906. $500,000. Thirty-five wells, Kern County. (Property leased to Standard Oil Company February 14, 1917.)

SUNSET OIL COMPANY, THE,
719 State St., Santa Barbara, Cal. F. A. Conant, President. Y. C. Hassinger, Secretary. June 21, 1899. $50,000. Kern County.

SUNSET ROAD OIL COMPANY,
Box 478, Maricopa, Cal. John Bennett, President. E. R. Hough, Secretary. June 22, 1905. $2,500,000. Kern County.

SUNSHINE OIL COMPANY,
Woodland, Cal. Care J. M. Day. July 15, 1910. $150,000.

SURF OIL COMPANY,
1114 Union Oil Bldg., Los Angeles, Cal. W. L. Stewart, President. John McPeak, Assistant Secretary. December 19, 1902. $500,000.

SUSSEX OIL COMPANY,
Room 411, 332 Pine St., San Francisco, Cal. F. E. Fitzpatrick, President. Edward Fox, Secretary. November 11, 1910. $2,500.

*S. W. & B. OIL COMPANY,
622 Merchants Exchange Bldg., San Francisco, Cal. A. D. King, Vice President. V. B. Fletcher, Assistant Secretary. March 23, 1904. $400,000. Five wells, Fresno County.

SWAN OIL COMPANY,
Visalia, Cal. A. Lewis, Vice President. H. Jerusalem, Secretary. January 8, 1900. $15,000.

SYNDICATE OIL COMPANY,
San Luis Obispo, Cal. E. W. Clark, President. P. M. Gregg, Secretary. March 18, 1905. $250,000.

SYNDICATE PETROLEUM COMPANY,
424 W. Thirty-eighth St., New York, N. Y. Care Manhattan Soap Company. Oscar M. Burke, President. E. E. Helyer, Secretary. March 26, 1912. $50,000. Kern County.

*TAMALPAIS OIL COMPANY,
149 California St., San Francisco, Cal. E. A. Bunker, President. F. F. Bostwick, Secretary. March 31, 1910. $500,000. Three wells, Kern County.

TANNEHILL OIL COMPANY,
1815 Cherokee Ave., Hollywood, Cal. L. B. Tannehill, President. C. C. Tannehill, Secretary. February 4, 1909. $250,000. Kern County.

TAPO OIL COMPANY,
Santa Paula, Cal. S. G. Graham, President. Allan C. McKevitt, Secretary. April 27, 1900. $1,000,000.

TECUMSEH PETROLEUM COMPANY,
Spreckels Bldg., San Diego, Cal. W. H. Egan, President. A. J. Razeto, Secretary. February 2, 1918. $225,000.

*TEJON OIL COMPANY,
P. O. Box 271, Bakersfield, Cal. H. R. Peacock, President. Peter McCart, Secretary. November 9, 1908. $20,000. One well, Kern County.

TEMPLE OIL COMPANY,
909 Title Insurance Bldg., Los Angeles, Cal. F. C. van Deinse, President. R. J. Pagen, Secretary. July 30, 1892. $60,000.

THETA OIL AND LAND COMPANY,
260 California St., San Francisco, Cal. Donald Y. Campbell, President. W. C. de Fremery, Secretary. February 20, 1900. $48,380. Kern County.

36 OIL COMPANY,
Room 3, Farmers National Bank Bldg., Fresno, Cal. December 24, 1900. $500,000.

THIRTY THIRTY TWO LAND COMPANY,
1008 Security Bldg., Los Angeles, Cal. J. M. Danziger, President. Geo. L. Reynolds, Secretary. December 8, 1910. $8,500.

32 OIL COMPANY,
836 H. W. Hellman Bldg., Los Angeles, Cal. W. C. Price, President. W. R. Wheat, Secretary. December 14, 1908. $10,000.

JOHN THOMAS OIL COMPANY,
91 Temple Block, Los Angeles, Cal. H. Clay Needham, President. James H. Blanchard, Secretary. August 6, 1900. $336,000.

THREE TWENTY OIL COMPANY,
101 Edgerly Bldg., Fresno, Cal. M. R. Maclary, Vice President. F. G. Story, Secretary. March 23, 1910. $500,000.

TIA JUANA VALLEY OIL COMPANY,
323 Timken Bldg., San Diego, Cal. September 16, 1910. $70,000.

TIBER PACIFIC OIL COMPANY,
412 Bumiller Bldg., Los Angeles, Cal. J. M. Roberts, President. A. L. Ellis, Secretary. August 5, 1914. $325,000.

TIDAL WAVE OIL COMPANY,
Care G. W. Glines, 2306 Second St., Selma, Cal. T. B. Matthews, Vice President. G. W. Glines, Secretary. July 22, 1899. $25,000.

TIGER OIL COMPANY,
614 Mills Bldg., San Francisco, Cal. Care Frank V. Bell. January 11, 1918. $10,000.

TIMBER CAÑON SYNDICATE,
Santa Paula, Cal. H. S. Williams, Manager.

TITICACA OIL COMPANY,
617 Merritt Bldg., Los Angeles, Cal. Chester W. Brown, President. F. B. Sutton Secretary. May 11, 1905. $1,000,000.

***TOPAZ OIL COMPANY,**
Box 34, Bakersfield, Cal. A. J. Woody, President. F. A. Young, Secretary. June 25, 1908. $20,000. Two wells.

TOP KNOT OIL COMPANY,
421 N. Main St., Santa Ana, Cal. A. D. Bishop President. A. J. Visel, Secretary. October 5, 1900. $200,000. Kern County.

TORREY CAÑON OIL COMPANY,
1232 Merchants Exchange Bldg., San Francisco, Cal. C. B. Wingate, President. G. M. Murphy, Secretary. July 1, 1910. $200,000.

TOWSLEY CANYON OIL COMPANY,
829 Investment Bldg., Los Angeles, Cal. J. D. Coplen, President. J. H. Borders, Secretary. July 16, 1915. $25,000.

***TRADERS OIL COMPANY,**
616 Union Oil Bldg., Los Angeles, Cal. M. V. McQuigg, President. A. J. Wallace, Secretary. July 13, 1907. $1,500,000. Twenty-five wells, Fresno County; 27 wells, Kern County.

***TRAFFIC OIL COMPANY,**
616 Union Oil Bldg., Los Angeles, Cal. M. V. McQuigg. President. A. J. Wallace, Secretary. April 12, 1910. $2,500,000. Fourteen wells, Kern County.

TRES SIERRITAS OIL AND MINING COMPANY,
P. O. Box 505, Lemoore, Cal. John H. McGlashan, President. Edw. P. Ammerman, Secretary. October 21, 1899. $60,000.

TRI-STATE OIL COMPANY,
La Habra, Cal. F. G. Philipps, President. E. B. Coil, Secretary. March 13, 1912. $500,000.

***TROJAN OIL COMPANY,**
401 Union Oil Bldg., Los Angeles, Cal. A. J. Aber, President. B. M. Howe, Secretary. May 19, 1914. $500,000. One well, Kern County.

TRUE OIL COMPANY, THE,
714 Story Bldg., Los Angeles Cal. Frank H. True, President. E. E. Prime, Secretary. February 23, 1917. $2,000.000.

TULARE OIL AND MINING COMPANY,
115 N. K St., Tulare, Cal. L. E. Schoenemann, President. C. W. Cobb, Secretary. November 1, 1890. $300,000. · Kern County.

***TUMBADOR OIL COMPANY,**
1112 Merchants National Bank Bldg., San Francisco, Cal. W. F. Williamson, President. E. M. Eddy, Secretary. May 5, 1910. $500,000. Seven wells, Kern County.

TUNNEL PETROLEUM COMPANY,
906 S. Hill St., Los Angeles, Cal. F. R. Campbell, President. H. A. Dunn, Secretary. April 28, 1916. $250,000.

TURNER OIL COMPANY (Los Angeles),
2474 E. Ninth St., Los Angeles, Cal. G. L. Holton, President. Robt. G. Holton, Secretary. June 14, 1899. $150,000.

TURNER OIL COMPANY (San Francisco),
180 Sutter St., San Francisco, Cal. Joseph Seeley, President. J. W. Pauson, Secretary. November 5, 1904. $50,000. Fresno County.

***T. W. COMPANY,**
Box 34, Bakersfield, Cal. T. M. Young, President. G. R. Peckham, Secretary. March 12, 1909. $100,000. Five wells, Kern County.

TWENTIETH CENTURY OIL COMPANY,
1927 Mariposa St., Fresno, Cal. A. V. Lesenby, President. W. O. Miles, Secretary. October 25, 1900. $200,000.

TWENTY-FOUR OIL COMPANY,
1017 J St., Fresno, Cal. Geo. Kaehler, President. A. C. Ruschbaupt, Secretary. December 1, 1909. $24,000.

TWIN CITIES OIL COMPANY,
Broad St., Nevada City, Cal. C. E. Clinch, President. D. E. Morgan, Secretary. May 20, 1901. $250,000.

UNION ANNEX OIL COMPANY,
1210 Washington Bldg., Los Angeles, Cal. J. S. Torrance, President. February 24, 1903. $1,000,000.

UNION KERN OIL COMPANY,
545 I. W. Hellman Bldg., Los Angeles, Cal. July 30, 1910. $1,000,000.

***UNION OIL COMPANY OF CALIFORNIA,**
1114 Union Oil Bldg., Los Angeles, Cal. W. L. Stewart, President. John McPeak, Secretary. October 17, 1890. $5,000,000, Orig.: $50,000,000, Inc. Eighteen wells, Fresno County; 18 wells, Kern County; 65 wells, Orange County; 84 wells, Ventura County; 102 wells, Santa Barbara County.

***UNITED CRUDE OIL COMPANY, THE,**
P. O. Box 561, Maricopa, Cal. E. H. Loveland, President. August 16, 1908. $500,000. Four wells, Kern County.

UNITED DEVELOPMENT COMPANY,
193 E. E St., Coalinga, Cal. O. D. Loftus, President. Guy H. Salisbury, Secretary. September 21, 1909. $45,000.

UNITED MIDWAY OIL COMPANY,
Box 337, Visalia, Cal. J. C. Newman, President. C. E. Groat, Secretary. March 5, 1910. $100,000. Kern County.

***UNITED OIL COMPANY, THE,**
1131 Investment Bldg., Los Angeles, Cal. C. F. Whittier, President. K. E. Steinbauer, Secretary. November 19, 1909. $2,000,000. Ten wells, Kern County.

UNITED PETROLEUM COMPANY,
1114 Union Oil Bldg., Los Angeles, Cal. Lyman Stewart, President. John McPeak, Secretary. (Dissolved.)

U. S. OIL AND MINING COMPANY,
Box 246. Bakersfield, Cal. Martin Coyne, President. L. Hirshfeld, Secretary. December 23, 1899. $300,000. Kern County.

U. S. OIL REFINING AND PRODUCTION COMPANY,
316 Hobart Bldg., San Francisco, Cal. J. C. Kemp van Ee, President. P. F. Unger, Secretary. January 27, 1910. $1,000,000.

UNITED WESTERN CONSOLIDATED OIL COMPANY,
Hobart Bldg., San Francisco, Cal. A. G. Wilkes, President. Fred Shingle, Secretary. May 1, 1917. $3,000,000.

***UNITED WESTERN OIL COMPANY,**
705 Hobart Bldg., San Francisco, Cal. John McKeon, President. A. B. Kast, Secretary. April 12, 1916. $500,000. One well, Kern County.

***UNIVERSAL OIL COMPANY,**
510 Crocker Bldg., San Francisco, Cal. R. N. Bishop, President. R. A. Morton, Secretary. April 27, 1911. $6,000,000. Twenty-four wells, Kern County.

VALLEY OIL COMPANY,
Care J. A. Fleutsch, Coalinga, Cal. S. W. Morshead, President. J. A. Fleutsch, Secretary. February 18, 1909. $100,000.

VANCOUVER MIDWAY OIL COMPANY,
310 Sansome St., San Francisco, Cal. A. L. Weil, President. M. Syme, Secretary. January 10, 1911. $100,000. Kern County.

VANDERLIP OIL COMPANY,
114 E. Fourth St., Santa Ana, Cal. Geo. A. Edgar, President. H. C. Vanderlip, Secretary. February 16, 1901. $200,000. Kern County.

VENTURA OIL LANDS COMPANY,
433 California St., San Francisco, Cal. R. K. Barrows, President. A. E. Boynton, Secretary. (Dissolved.)

***VENTURA PACIFIC OIL COMPANY,**
412 Owl Drug Bldg., San Diego, Cal. F. E. Wisecup, President. E. G. Dehm, Secretary. October 18, 1912. $225,000. Five wells, Ventura County.

VERA CRUZ OIL COMPANY,
1101 Story Bldg., Los Angeles, Cal. Wm. Perry, President. C. A. Goodrich, Secretary. November 19, 1915. $100,000.

VERATINA OIL COMPANY,
348 Hayes St., San Francisco, Cal. A. W. Craig, Secretary. February 27, 1901. $150,000.

***VESTA OIL COMPANY,**
409 Consolidated Realty Bldg., Los Angeles, Cal. Geo. F. Freeman, President. L. Schenck, Secretary. August 7, 1900. $300,000. Eleven wells, Kern County.

***VICTOR OIL COMPANY,**
1109 I. N. Van Nuys Bldg., Los Angeles, Cal. H. D. Colson, President. Frank C. Winter, Secretary. March 30, 1910. $500,000. Four wells, Kern County.

VICTORIA OIL COMPANY,
605 Van Nuys Bldg., Los Angeles, Cal. Charles Murray, President. E. J. Murray, Secretary. November 30, 1914. $50,000.

***VIRGINIA OIL COMPANY,**
Box 655, Los Angeles, Cal. John M. Sands, President. J. B. Kessinger, Secretary. May 26, 1914. $25,000. Twenty-seven wells, Kern County.

***VISALIA MIDWAY OIL COMPANY,**
110 S. Court St., Visalia, Cal. E. L. Smith, President. Geo. D. Smith, Secretary. March 9, 1901. $500,000. Four wells, Kern County.

VISALIA OIL COMPANY,
626 S. Garden St., Visalia, Cal. Louis Lucier, President. Otto Luhdorff, Secretary. April 13, 1914. $100,000. Kern County.

VISHNU OIL COMPANY,
300 Crocker Bldg., San Francisco, Cal. W. Gregg, Jr., President. W. R. Berry, Secretary. June 20, 1900. $500,000.

*VOLCAN OIL AND REFINING COMPANY,
First and I Sts., P. O. Box 83, San Diego, Cal. C. H. Wagner, President. G. F. Nolan, Secretary. January 24, 1902. $550,000. Seven wells, Kern County.

WABASH OIL COMPANY,
310 Sansome St., San Francisco, Cal. John Barneson, President. W. J. Dinsmore, Secretary. April 14, 1903. $300,000, Orig.; $15,000, Dec.

WALKER OIL COMPANY,
305 Fifth St., Coalinga, Cal. November 1, 1909. $300,000.

*W. AND S. OIL COMPANY,
1112 Merchants National Bank Bldg., San Francisco, Cal. W. F. Williamson, President. D. E. Gunn, Secretary. May 19, 1911. $200,000. Four wells, Kern County. (Property leased to Potter Oil Company of California, September, 1917.)

*WARD OIL COMPANY,
Room 3, Farmers National Bank Bldg., Fresno, Cal. Geo. L. Warlow, President. Chester H. Warlow, Secretary. November 15, 1907. $100,000. Eight wells, Fresno County.

WASHINGTON COALINGA OIL COMPANY,
Care Harry Dalton, 601 Foster Bldg., Denver, Col. Fresno County.

*WATSONVILLE OIL COMPANY,
339 Main St., Watsonville, Cal. M. B. Tuttle, President. A. W. Cox, Secretary. December 15, 1896. $100,000, Orig.; $200,000, Dec. Four wells, Santa Clara County.

WELCH, P.,
Maricopa, Cal.

WELCOME OIL COMPANY,
78 Bacon Bldg., Oakland, Cal. J. J. Enos, President. Frank Rogers, Secretary. October 14, 1909. $200,000.

*WENONAH OIL COMPANY,
1112 Merchants National Bank Bldg., San Francisco, Cal. W. F. Williamson, President. E. M. Eddy, Secretary. March 15, 1911. $650,000. Six wells, Kern County. (Property sold to Tumbador Oil Company.)

WESCO PETROLEUM COMPANY,
502 Merritt Bldg., Los Angeles, Cal. D. J. Gouyer, President. Kern County.

WEST AMERICAN OIL COMPANY,
Care S. W. Waterhouse, 474 N. First St., San Jose, Cal. S. W. Waterhouse, President. Annie C. Waterhouse, Secretary. September 2, 1914. $25,000.

*WEST COAST OIL COMPANY,
55 New Montgomery St., San Francisco, Cal. Wm. Sproule, President. P. G. Williams, Secretary. June 23, 1908. $5,000,000. Ten wells, Los Angeles County; 48 wells, Orange County.

WESTERN MINERALS COMPANY,
704 West Coast Life Bldg., 354 Pine St., San Francisco, Cal. H. L. Tevis, President. F. G. Drum, Secretary. December 14, 1899. $100,000.

WESTERN OIL AND GAS COMPANY, LTD.,
511 Hutton Bldg., Spokane, Wash. Jno. M. Downs, President. L. M. Weaver, Secretary. February 14, 1917. $150,000.

WESTERN OIL COMPANY,
1031 Black Bldg., Los Angeles, Cal. F. P. W. Hill, President. G. Zeeman, Secretary. April 15, 1912. $10,000.

*WESTERN UNION OIL COMPANY,
402 Bradbury Bldg., Los Angeles, Cal. C. P. Bagg, President. Morris Albee, Secretary. April 19, 1900. $1,000,000. Forty wells, Santa Barbara County.

*WEST HUASNA OIL COMPANY,
Orcutt, Cal. J. F. Forbes, President. A. Mailloux, Secretary. Two wells, Ventura County. (Dissolved.)

WEST PENN COMPANY, INC., THE,
Brower Bldg., Bakersfield, Cal. F. L. Bartlett, President. F. L. Stowell, Secretary.

*WEST SIDE OIL COMPANY,
608 Grosse Bldg., Los Angeles, Cal. Geo. W. Walker, President. Lester L. Robinson, Secretary. December 7, 1908. $100,000. Three wells, Kern County.

WEST SLOPE OIL COMPANY,
300 E. Main St., Visalia, Cal. C. J. Giddings, President. J. Sub Johnson, Secretary. June 1, 1911. $1,000,000.

WEST STATES PETROLEUM COMPANY,
Hobart Bldg., San Francisco, Cal. April 17, 1917. $1,000,000. (Property sold to United Western Consolidated Oil Company.)

WHITE ROCK PETROLEUM COMPANY,
1386 Seventh Ave., San Francisco, Cal. W. I. Sterett, President. A. A. Cohn, Secretary. November 18, 1911. $300,000.

*WHITE STAR OIL COMPANY,
510 Trust and Savings Bldg., Los Angeles, Cal. Richard Arenz, President. Chas. E. Putnam, Secretary. February 8, 1909. $1,000,000. Eight wells, Ventura County.

WHITTIER CONSOLIDATED OIL COMPANY,
1004 Security Bldg., Los Angeles, Cal. Thos. A. O'Donnell President. Ellis T. Yarnell, Secretary. June 7, 1900. $1,000,000.

WHITTIER CRUDE OIL COMPANY,
200 S. Los Angeles St., Los Angeles, Cal. L. D. Sale, President. H. G. A. Lovell, Secretary. January 22, 1900. $300,000. Seven wells, Los Angeles County.

WHITTIER OIL AND DEVELOPMENT COMPANY,
104 W. Philadelphia St., Whittier, Cal. C. W. Clayton, President. S. W. Barton, Secretary. May 31, 1900. $250,000.

***WILBERT OIL COMPANY, THE**
1704 Nineteenth St., Bakersfield, Cal. H. A. Jastro, President. F. G. Munzer, Secretary. September 18, 1907. $125,000. Eight wells, Kern County.

WILCOX OIL COMPANY,
Room 637, 58 Sutter St., San Francisco, Cal. Chas. G. Wilcox, President. A. N. Baldwin, Secretary. February 21, 1911. $1,000,000.

WILKES HEAD OIL COMPANY,
705 Hobart Bldg., San Francisco, Cal. Thomas Wilkes, President. A. B. Kast, Secretary. November 3, 1913. $300,000.

***H. S. WILLIAMS OIL COMPANY,**
112 Market St., San Francisco, Cal. H. S. Williams, President. John Lee, Jr., Secretary. March 30, 1916. $25,000. Two wells, Kern County.

WILSHIRE OIL COMPANY,
417 Higgins Bldg., Los Angeles, Cal. Care A. P. Michael Harlain. August 30, 1917. $250,000.

W. J. OIL COMPANY,
Care E. F. Coons, Bakersfield, Cal. S. P. Wible, President. Edith F. Coons, Secretary. October 23, 1908. $25,000. Kern County.

W. K. OIL COMPANY,
180 Sutter St., San Francisco, Cal. John Hinkel, President. J. W. Pauson, Secretary. December 8, 1904. $25,000. Fresno County.

***W. M. AND M. OIL COMPANY, THE,**
Box 501, Fresno, Cal. M. L. Woy, President. D. C. Sample, Secretary. November 17, 1909. $100,000. Four wells, Fresno County.

***W. T. & M. COMPANY,**
Box 34, Bakersfield, Cal. T. M. Young, President. G. R. Peckham, Secretary. April 19, 1909. $500,000. Six wells, Kern County.

WYOMING CONSOLIDATED OIL COMPANY,
620 N. Marengo Ave., Pasadena, Cal. C. W. Leighton, President. A. L. Twombly, Secretary. July 18, 1912. $3,000,000.

YELLOW CREEK EXPLORATION COMPANY,
Merchants National Bank Bldg., San Francisco, Cal. Care W. F. Williamson. November 22, 1917. $25,000.

YELLOWSTONE OIL COMPANY,
711 Merchants National Bank Bldg., Los Angeles, Cal. J. H. Collier, President. Ira L. Vance, Secretary. July 10, 1907. $1,000,000. Kern County.

YORBA OIL COMPANY,
1004 Title Insurance Bldg., Los Angeles, Cal. C. L. Wallis, President. J. E. Wallis, Secretary. May 29, 1914. $75,000.

***YORK COALINGA OIL COMPANY,**
607 First National Bank Bldg., San Francisco, Cal. Robert Hays Smith, President. F. M. Bortner, Secretary. April 30, 1902. $300,000. Three wells, Fresno County.

YOSEMITE OIL COMPANY,
414 Oakland Bank Bldg., Oakland, Cal. W. E. Beck, President. O. E. Hotchkiss, Secretary. October 7, 1899. $200,000 Orig.; $10,000, Dec.

***ZENITH OIL COMPANY,**
428-9 I. W. Hellman Bldg., Los Angeles, Cal. Edward Strasburg, President. A. F. Schiffman, Secretary. April 20, 1900. $30,000. Two wells, Los Angeles County.

***ZIER OIL COMPANY,**
1002 Crocker Bldg., San Francisco, Cal. Wm. L. McGuire, President. C. H. Holbrook, Jr., Secretary. April 5, 1905. $100,000. Fourteen wells, Fresno County.

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